University of Hong Kong

Reply to Provisional Legislative Council on Information Policy

5 November 1997

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Executive Summary

In his recent Policy Address, Chief Executive Tung Chee Hwa drew attention to the important role that Information Technologies (IT) will attain helping shape Hong Kong's future. As a policy objective, the Chief Executive also announced that Hong Kong should be a leader, not a follower, in the information world of tomorrow. He pledged significant governmental support to help achieve this important objective. The University of Hong Kong (HKU) welcomes the Chief Executive's IT initiative and embraces the opportunity to participate as the people of Hong Kong move forward into the next millennium. We, too, share the Chief Executive's estimation of the critical nature of these issues and his sense of urgency in this regard.

In this paper we discuss the role and importance of IT, IT developments in Hong Kong, and IT in education in general and at HKU specifically. In the discussion, we recognize the many advances made by both the private and public sectors in IT and make specific recommendations for how this progress may be supported, sustained, and accelerated.

We recommend the Government of Hong Kong:

- engage in long term strategic IT planning and identify clearer objectives and benchmarks.

- provide policies and resources to create a total-information-literate society in which IT access is available to all Hong Kong citizens throughout the Special Administrative Region.

- develop policy to subsidize computer purchases and Internet access for low-income families so that all of our citizens may access on-line educational opportunities, as well as participate as full members in the commercial, cultural, and social benefits of a digital society.

- encourage participation and competition by IT companies in Hong Kong to ensure better and cheaper services to consumers.

- upgrade bandwidth of Internet connections from Hong Kong to 384 Mbps by the year 2000

- monitor network traffic closely to evaluate whether these improvements provide sufficient bandwidth for communications, educational, professional, commercial, and entertainment purposes.

- take the initiative to encourage the development of large-scale digital library projects to support learning at all levels from elementary schools to adult education.

- allocate more resources and develop better management mechanisms to finish the

TradeLink Project in the shortest possible time.

- designate the Hong Kong Production Council or a similar organization to develop policy for technology transfer for large-scale infrastructure projects.

- put in place the necessary legal measures to protect participants in the electronic marketplace from unscrupulous operators and to settle disputes related to Internet commerce.

- make available additional resources to develop electronic projects to promote Hong Kong and to attract business, industry, and tourism.

- encourage the Hong Kong Stock Exchange to add electronic financial statement filing system similar to the EDGAR (Electronic Data Gathering, Analysis and Retrieval) system of the US Securities and Exchange Commission (SEC).

- institute a policy in Hong Kong in which computer and Internet access for every student and teacher will be at a ratio of 1:1.

- develop programmes to prepare teacher-leaders to assist their colleagues in IT implementation.

- IT efforts focus on the development of our citizen's "information literacy," not their "computer literacy."

- encourage the further development of a total health care information superhighway by allocating more resources to R&D projects to establish more on-line medical projects and services.

- provide significant new resources to upgrade the infrastructure at tertiary institutions in order that they may build technology-rich and IT enabled learning environments.

- provide resources for the establishment of an on-line clearinghouse of information about commercially available courseware.

- work with the IT industry to sponsor the creation of one or more New Media Centres at tertiary institutions in Hong Kong.

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- develop and support programmes to ensure that all incoming tertiary students own a personal computer.
- provide resources to develop and implement the most cost-effective, high speed, ubiquitous system of network connectivity possible on all Hong Kong tertiary campuses.

HKU intends to move forward to create a new digital campus environment

with technology-rich teaching and learning opportunities for all of our staff and young people. We are unequivocally committed to the development of the information literacy of students and staff so that they may excel in their scholarly pursuits, prosper in their chosen professions, benefit from lifelong learning opportunities, and make a positive contribution to Hong Kong society now and into the next century.

We recognize that there are many obstacles to the use of IT to improve teaching, learning, and research, not the least of which is costs. But, as the UGC has observed, failure to respond to the opportunities and challenges of IT will most assuredly side-line Hong Kong's tertiary institutions as developments proceed apace elsewhere. We have resolved that this will not happen at HKU, and we welcome the Chief Executive's initiatives in support of IT developments.

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Introduction

1. In his recent Policy Address, Chief Executive Tung Chee Hwa drew attention to the important role that Information Technologies (IT) will attain helping shape

Hong Kong's future. As a policy objective, the Chief Executive also announced that Hong Kong should be a leader, not a follower, in the information world of tomorrow. He pledged significant governmental support to help achieve this important objective. The University of Hong Kong (HKU) welcomes the Chief Executive's IT initiative and embraces the opportunity to participate as the people of Hong Kong move forward into the next millennium. We, too, share the Chief Executive's estimation of the critical nature of these issues and his sense of urgency in this regard.

2. William J. Mitchell, Dean of the MIT School of Architecture, in his book *City of Bits*, asserts that the most critical task facing society is not installing "the digital plumbing of broadband communications links and associated electronic appliances" but that of "imagining and creating digitally mediated environments for the kinds of lives that we will want to lead and the sorts of communities that we will want to have." The Chief Executive's IT Initiative is a welcome first step in initiating the dialog necessary for our citizens to imagine and create Hong Kong's digital future.

3. In our response, we discuss:

   • the role and importance of IT,
   • IT developments in Hong Kong, and
   • IT in education in general, and at HKU specifically.

IT: A Means To An End

4. There is no doubt that IT implementation is among the highest national priorities to most countries. National leaders in this region believe that IT is a critical factor in maintaining or creating their countries' competitive strengths and have initiated projects to move their countries ahead, e.g., the Intelligent Island and IT2000 projects in Singapore, the Multimedia Corridor project in Malaysia, and the Taiwan government's recently announced IT policy to double IT R&D expenditure and manpower by 2005. Facing such challenges from neighboring countries, let alone from the rest of the world, it is extremely important to understand where Hong Kong IT developments are now and what needs to be done in order to maintain and continue to develop our competitive strengths.

5. A prosperous society in the 21st century will depend, to a significant extent, on how successful Hong Kong is in deploying IT in support of economic, social, educational, and cultural goals. Information flow has alway been a strength of Hong Kong over neighboring societies, but this situation could easily change if measures are not taken to protect this advantage. IT is of critical importance because of the opportunity it offers to position Hong Kong as the global centre of finance, commerce, education, and culture in Asia. We are indeed, as the Chief Executive pointed out, "entering an era of increasingly open, free, and borderless competition." IT offers the potential to ensure Hong Kong's economic position and enhance its world-wide reputation as a free, vigorous, and productive society. Appropriate use of IT can expand income opportunities for our citizens, increase

productivity, help forge new partnerships between industry, government, and educational institutions, facilitate the development of new markets for our goods and services, and secure Hong Kong's position in the global economy.

6. In a sense, the world situation vis-_-vis IT is similar to that of the past when the location of the developing transportation infrastructure necessarily determined the fate of entire communities. Simply put, those communities located where railroad tracks were laid or roads were built prospered. Their citizens could receive timely information and reach markets simply and cost-effectively. Communities bypassed by the developing transportation infrastructure became economic backwaters; their citizens unable to participate in the benefits of a broadening marketplace. Even today, the placement of a new container port, bridge, or highway can help determine long term economic prospects for a region.

7. As we move into a new century, nations are busily engaged in building a new kind of transportation infrastructure to support a global economy: a digital highway over which information and communications will flow, financial transactions will take place, workers will work, goods and services will be requested and delivered, and the next generation will be educated. Hong Kong can ill afford to ignore these developments lest its citizens become trapped in a backwater of the information age.

8. Generally speaking, the current conditions of IT use and development in Hong Kong are encouraging. For example, the Interactive Multimedia Services (IMS) launched by Hong Kong Telecom is expected to impact how Hong Kong residents live and the Hong Kong Health Information Superhighway Project aims to provide a seamless health care delivery system which will allow physicians access to patient records from any hospital or clinic.

9. While it is helpful that the Government has taken note of IT's potential impact on our society and will set up an organization to coordinate the efforts in this area, it is a fact that IT investment in Hong Kong from both the government and private sectors is far below that of neighboring socieities such as Taiwan and Singapore, especially in research and development (R&D) activities. Coordinating telecommunications, the Internet, multimedia, software, hardware, and infoware technologies to improve the quality of living and global competition strengths will be both a challenging and expensive task.

10. We believe that this can be done better if clearer objectives and benchmarks can be identified in as part of long term strategic planning, if more resources can be allocated, and better and more transparent monitoring systems can be developed. In the past, it was difficult for Government to develop long-term strategic plans. Now, we must do so. Many IT investments or projects are not short-term. They take years to plan, to execute, and to realize the benefits. For example, education and training for IT, especially for activities which require higher education degrees such as R&D, take several years. We urge the government to aggressively extend the strategic planning horizon to ten years or longer. Benchmarks can be set for short-term (year 2000), mid-term (year 2005) and long-term (2010) results.

11. The impact of IT investments is difficult to measure only by consideration of profits or revenues. However, to some extent IT developments will determine which countries will be the economic winners or losers in the twenty-first century. In our view, Hong Kong must provide the policies and resources to create a total-information-literate society. As we know, the ability to use English fluently is one of the competitive strengths of Hong Kong residents. The language of international communications on the Internet is English. By participating in collaborative exchanges with students in other countries this fluency can be strengthened through the use of IT.

12. The next generation of Hong Kong graduates will face tougher competition from students who have been educated in top China universities such as Tsinghua or Beijing, and in other institutions abroad. We might well ask what are the competitive strengths of our young people? Speaking and writing fluent English may not be sufficient. In addition, the ability to use IT to learn, to access information, to solve problems and to communicate and interact with people who are thousands of miles away will be another competitive strength for our younger generation.

13. Providing universal access to IT can help ensure equal opportunity, both in terms of competitive skills as well as education opportunities, for our young people. None of our children should be deprived of access to information or education via IT or we may create a society of information haves and have nots, the well educated and the not so well educated – an outcome none of us would seek or think desirable. Information literacy - the ability to use information technologies to search for information, to evaluate its worth, and to apply it to solve problems and to interact with people - should become a major competitive strength of <u>all</u> of our young people.

14. Ordinary citizens world-wide are embracing these new opportunities; thus even more so must government initiatives help lead the way. According to the 1997 European Computer Literacy Report, Great Britain has the highest computer-to-student ratio in the world, and fully one-third of British households now contain a computer, higher even than their estimation of 28% of U.S. PC households. About 20% of British households have Internet access. A recent study in the United States found that 62% of 500 companies surveyed report more employees working via telecommuting than they did two years ago. The South China Morning Post recently reported that Internet use in Hong Kong is soaring, with a recent survey showing about 500,000 people now use the world's newest communications technology. The number of new Internet users in Hong Kong is nearly double last year's estimate.

15. Although critical to economic, educational, and cultural progress in the future, IT development and implementation can be a complex and difficult undertaking as events elsewhere have shown. Far-sighted, systemic policies will be necessary to address:

    • infrastructure improvement,

- software development,
- coordination of IT efforts and expenditures,
- human factors such as education and support, and
- content creation.

16. In other words, the Government must not only facilitate the construction of Hong Kong's local version of the digital highway and high speed "access ramps" to the global digital highway, but must put in place well coordinated and well-funded opportunities for innovation and experimentation, for training, education and on-going support, and for individuals to share the results of such work. It must also work to ensure the development of information resources to support business, industry, culture, and education.

17. In a few short years we will enter the new millennium. IT developments make it possible to envisage a time in the near future when it is customary and routine for Hong Kong citizens to engage in global electronic commerce and communication, when pollution and traffic problems are significantly diminished as people employ IT to work from home, when Hong Kong industries buy and sell goods and services world-wide in an electronic global economy, when our people engage in electronic cultural and social exchanges with citizens of countries across the planet, and when our students form electronic learning communities with peers, teachers, and mentors from business and industry around the world.

18. Telecommunication technologies can provide our young people with access to top scholars in the most isolated spots in the world. Already students in many countries have communicated with oceanographers deep under the sea in submarines mapping the ocean floor, with astronauts in outerspace, and with geologists in Antartica. Many successful digital entrepreneurs are working and enjoying their lives by telecommuting – making use of the Internet to communicate with their employers and deliver their products. Electronic commerce is moving business transactions from the physical market place to a "cyber" market space. Electronic home shopping sites are proliferating making such things as multimedia product catalogues and virtual property walk-throughs available over the Internet. Some electronic malls or cyber book stores, such as Amazon Books, have been in existence for less than two years and yet already report revenues of several hundred million dollars.

IT Developments in Hong Kong

19. In this section, we discuss the following IT developments in Hong Kong:

    1. Telecommunication, multimedia and digital library
    2. Production, manufacturing, shipping and transportation
    3. Electronic commerce and service industries
    4. Education and health care

Telecommunication, multimedia and digital library

1. Telecommunication will be one the most critical factors in the development and growth of Hong Kong's economy. This is illustrated by successful stories in the shipping and transportation industries, as well as in the banking and financial industries. Firms in these industries rely on high-quality, stable, secure, and low-cost telecommunication to coordinate and manage their daily operations. The telecommunication infrastructure in Hong Kong is something that we should be proud of. Hong Kong is one of the first societies to implement a 100% digital backbone, and fiber is used extensively for building these networks.

2. Hong Kong has wonderful connections with the rest of the world. International long-distance phone calls or video conference signals can be transmitted through fiber, satellite or microwave. Hong Kong Telecom has invested heavily in Interactive Multimedia Services (IMS), which use high-bandwidth fiber networks to deliver services such as video-on-demand, electronic home shopping, and interactive multimedia games to most residents. Many other companies are also interested in video-on-demand or interactive multimedia services and are willing to invest in the development of different carriers such as cable and cable modems to deliver the signals. The Government's policy should be to encourage such participation and competition to ensure better and cheaper services to the consumers. However, it is also important that the Government set up clear policy to avoid wasting resources in building infrastructures.

3. According to a poll by Surveying Research Hongkong reported in the South China Morning Post, about 30% of families in Hong Kong have computers and half of them are connected by modems to one of the Hong Kong Internet service providers (ISPs). To encourage this trend, we recommend government develop policy to subsidize computer purchases and Internet access for low-income families so that all of our citizens may access on-line educational opportunities, as well as participate as full members in the commercial, cultural, and social benefits of a digital society.

4. ISPs play an important role in building a total digital community. There are more than 90 ISPs in Hong Kong. However, we believe that the bandwidth of connections to the Internet is not sufficient for present demand and current plans are inadequate to address projected needs. By the year 2000, we believe all students in every school should have access to Internet-based educational resources and that all families should be able to make use of digital resources. The demand from business and industry is sure to grow, as is the home market for access for commercial and entertainment purposes.

5. The speed of Internet access from our campus network has been quite slow in the past year due to severe traffic congestion on the 2-Mbps HARNET-Internet link --- the Internet gateway to the U.S. for all UGC-funded local tertiary institutions. In tackling this unsatisfactory situation, the HKU Computer Centre has been working with the Joint University Computer Centre (JUCC) on a proposal for funding support from the UGC to implement a major upgrade of the HARNET (Hongkong Academic and Research Network) and its Internet connection. The plan is to increase the bandwidth of the HARNET-Internet link in three phases to T3 (45 Mbps) speed by year 2000 and to upgrade the speed of the inter-institution

links of HARNET from the present TI (1.5 Mbps) speed in phases to 20 Mbps. The UGC has already confirmed funding of the first two phases and implementation is underway

6. However, we feel that the upgrade proposal will still fall short of the anticipated explosive growth in demand of Internet access. We recommend that the upgrade to T3 speed should be implemented immediately and we recommend that the bandwidth of the Internet connections from the tertiary institutions be increased to 384 Mbps by the year 2000 instead. We also recommend that network traffic be closely monitored to evaluate whether these improvements provide sufficient bandwidth for communications, educational, professional, commercial, and entertainment purposes.

7. Hong Kong is developing a sound infrastructure for the delivery of digital signals. However, we feel that more attention must be paid to content, i.e., on-line information resources and services. The local content that can be accessed through Internet and World Wide Web is extremely inadequate. Most Internet users, either for educational purposes or non-education purposes, are mainly accessing information or homepages created in other countries. This is a critical issue. Hong Kong must be not only an information consumer but also a creator. We should value and promote our own culture and society. In a digital age, the best way to promote and preserve our culture and history is to create digital resources and services, e.g., virtual museums and digital library collections for users to access through the Internet. In Taiwan, National Taiwan University was offered a grant to develop a digital museum by digitizing and storing important historical documents.

8. The Hong Kong Government needs to develop similar initiatives to secure our place in cyber space. We believe that government should take the initiative to encourage developing large-scale digital library projects. The Open University of Hong Kong (OUHK) has issued a $40 million dollars contract to the Hong Kong University of Science and Technology (HKUST) to develop a digital library for their students. We feel more such initiatives should be encouraged and supported. Digital libraries should be used to support learning at all education levels from elementary schools to adult education. We would like to see large-scale digital library projects which cover engineering, arts, history, literature, science, and so forth, by the year 2000. All the contents of the textbooks and their supplementary reading materials, from elementary school to post-secondary school education should be available on the Internet. We should also encourage collaboration with the other institutes in China to exchange content.

Production, manufacturing, shipping and transportation

9. Hong Kong has enjoyed significant economic growth and prosperity in recent years. Hong Kong is one of the three major financial centers in the world. The use of IT and the free and instantaneous flow of information has been a key part of this growth and prosperity.

10. Hong Kong is also one of the manufacturing centers in this region. However,

beginning two decades ago, many manufacturing firms started to move their production lines into China or other Asian countries where cheaper labor was available. While the total amount of manufacturing employment shrank from its peak of 892,140 in 1980 to less than 500,000 today, the total amount of manufacturing value added has never decreased. On the contrary, it has maintained a steady growth of 4 percent a year during the past fifteen years. Numerically, it is translated into a 14.7 percent increase in value added per year for every person in the manufacturing sector.

11. The primary reasons behind this wonderful growth rate were the radical changes in allocating manufacturing resources/capabilities and the dynamic response to widely diverse market requirements. The competitive strength of Hong Kong manufacturing has shifted from low cost production on the shop floor to capability in coordination and management within the territory and across the border. Digital computers and communication technologies have played important roles in supporting the above transition. There are several factors which have been important to maintain or develop Hong Kong's competitive strengths in production and manufacturing. For example, Hong Kong has the airport and sea port facilities necessary to support cargo transportation. The Hong Kong Air Cargo Terminals Limited (HACTL) has the highest throughput and the lowest consignment mishandling rate in the world. Hong Kong also has the world's second busiest container port. The use of IT has been an important enabler in Hong Kong's outstanding transport infrastructure.

12. However, we believe improvements can be made in some areas. For example, compared with Singapore, the development of our TradeLink project (an electronic data interchange (EDI) project to support the electronic transmission of trade related documents) has been slow. In order to increase the competition strength and efficiency in the shipping industry, we should allocate more resources and develop better management mechanisms to finish the whole project in the shortest possible time.

13. Another issue is that some of the current large-scale IT projects, for example the airport management system of Chek Lap Kok airport, have been handled by consulting firms relying on expatriate expertise. In such cases it is critical that the knowledge and skills of the expatriate personnel be transferred to and acquired by local professionals. To ensure this process, we recommend that the Government designate the Hong Kong Production Council or a similar organization to develop policy for technology transfer for large-scale infrastructure projects.

Electronic commerce and service industries

14. Hong Kong has been very aggressive in using new concepts or new technologies to support business activities. Electronic commerce has begun to move business transactions from the market place into cyberspace. Electronic home shopping, electronic banking and investment, and video-on-demand are just some examples. Wellcome, which is a supermarket chain, use Internet services provided by Hong Kong Telecom IMS to sell grocery items. IMS also provides support for IKEA

to sell furniture and UA cinema to offer film tickets over the Internet. In addition, following the successful story of Amazon Book Cyberstore in the US, the first Chinese Book Cyberstore was launched in Hong Kong in June 1996. CompuServe Hong Kong is operated by Motorola AirCommunication, which delivers instant, seamless and world-wide data communications to several thousands local subscribers. However, there is no doubt that electronic commerce in Hong Kong is still in the early stages of development just as there is little doubt that electronic commerce will significantly change the way people in Hong Kong live.

15. Besides being an Internet Service Provider (ISP), Hong Kong Telecom IMS is also an Internet consultant which provides technical and managerial expertise to companies who would like to do business over the Internet. We recommend that government should develop a set of regulations and policies for Internet commerce. Government should put in place the necessary legal measures to protect participants in the electronic marketplace from unscrupulous operators and to settle disputes related to Internet commerce.

16. The Hong Kong Trade Development Council also uses World Wide Web (WWW) technologies to provide electronic advertising, electronic catalog, and electronic publishing services. The Hong Kong Tourist Association has made a good start at using the Internet to publicize Hong Kong as a tourist destination. We believe additional resources should be made available to develop electronic projects to promote Hong Kong and to attract business, industry, and tourism.

17. The Hong Kong Stock Exchange (HKSE) started to use computerized trading system in 1993. Its Automatic Order Matching and Execution System (AMS) has significantly improved the efficiency and throughput of the stock trading. We recommend the HKSE add electronic financial statement filing system similar to the EDGAR (Electronic Data Gathering, Analysis and Retrieval) system of the US Securities and Exchange Commission (SEC). Currently there are 15,000 companies that use EDGAR to file their financial documents, which include annual reports and quarterly reports. We believe such a system will be very helpful to the overseas investors where they can use an Internet browser to read companies' information before making investment decisions. Such a system would also help boost the image of the HKSE and investor's confidence.

Education and health care

18. IT has a critical role to play in the education of our youngsters. We applaud the Chief Executive's wisdom in recognizing this and advocating a Five-Year IT Education Strategy. It appears that Hong Kong tertiary institutions in general are much more advanced in this regard than are primary and secondary institutions. This is of great concern to us as the use of IT increases in university education and expectations for incoming student IT skills rise. We believe that the initiatives announced in the Policy Address will help improve educational opportunities throughout the educational system as our young people become more capable, as new and better learning materials are developed, and as academic staff become versed in making full use of IT for teaching and learning.

19. We believe one of the ultimate goals of Hong Kong's IT policy should be computer and Internet access for every student and teacher at a ratio of 1:1. In part, we draw this conclusion from considering what the situation would be in our business community if workers were required to share computers at a ratio of 10-15:1 as is currently suggested in the Secretary of Education's policy programme, or by considering how useful an educational tool the pencil would be if each were shared by 10 students.

20. As we move forward with the five-year strategy to promote the use of IT in education, teachers should be in the vanguard of change. A critical mistake often made when seeking to implement technology programmes like those proposed by the Chief Executive is to exclude teachers from the planning process, and to neglect the contributions they can make in helping explain IT and train their peers to make use of it. Teachers who understand the strengths and limitations of a technology in a classroom setting, are sensitive to the needs of our young people and teachers, and who understand staff development, are best positioned to provide information, training, and support. Programmes should be developed which train these individuals and the school system should enable them to train others.

21. As the new IT Education Strategy is implemented, we believe the focus of the effort should be on developing the "information literacy" of Hong Kong's students and teachers, not their "computer literacy." One need not know how a pencil is made to use it appropriately for writing, nor automotive mechanics to use a car successfully for transportation. Experience elsewhere has shown that when IT is treated as a separate subject taught by specialists, its use does not become widespread within an educational institution. Only by integrating IT use throughout the curriculum and embedding its use in the pursuit of authentic learning experiences can we expect it to become a normal part of our children and teachers' educational experiences.

22. IT has given rise to a shift of focus in the health care industry: from institution-centered to patient-centered. IT plays the role of an enabler bringing information to the fingertips of physicians, nurses, and other medical specialists. A very important role for IT is to act as an integrator providing seamless and complete information access to medical staff regardless of where they are located. The Hong Kong Health Information Superhighway was introduced by Hospital Authority (HA) in September 1994 to develop a web of communication networks, computers, databases and consumer electronic electronics that will put vast amounts of information at healthcare providers' and eventually end-users' fingertips. HKU's Faculty of Medicine is well advanced in the use of IT to support medical education including videoteleconferencing facilities which allow students to observe surgery without being present in the operating theater. The medical school of the Chinese University of Hong Kong has also begun projects in telemedicine to provide full-motion video to support distant diagnosis and consultation.

23. We feel that such efforts should be encouraged and further developed to create a total healthcare information superhighway to include services such as billing,

scheduling, consultation with physicians, instructions for medication, on-line health care tips, and remote health-monitoring. Sharing information, knowledge, and educational programmes among different medical institutions and schools should be another other critical goal of such a project. We recommend government allocate more resources to R&D projects to establish more on-line medical projects, distance learning opportunities for medical personnel, electronic research collaborations between medical schools and institutions, and connections with medical centers in other countries.

IT And Educational Needs

24. The nature of education is changing as are people's educational needs. In the past, it was possible to study for a few short years and become expert in a closely defined body of knowledge and to learn a clearly defined set of skills. This knowledge and the attendant skills could then be applied over the course of a lifetime in a rewarding and productive career. Education accommodated such educational needs by teaching fixed curricula within specific disciplines making use of methods which changed little over the years.

25. Today, an explosion of new ideas, information, technologies, and methods in nearly all disciplines has made such an educational approach untenable. It is no longer possible for an individual student to master an entire discipline in a few short years, especially as the frontiers of knowledge are regularly being extended. It has become necessary for us all to become life-long learners, continuously upgrading our skills, information-base, and understandings.

26. Teaching methods, which used to focus on the mastery of a discrete body of knowledge, are also changing. Critical thinking, problem-solving, knowledge construction, and information literacy – the ability to seek out, evaluate, incorporate, and intelligently apply new information – have taken central roles in curriculum reform efforts. Education is no longer viewed as a short-term process but is seen as a life-long endeavor in which individuals seek educational opportunities throughout their productive life span. An important goal of a university education is to prepare the next generation to continue to learn throughout their careers.

IT's Role in Meeting New Educational Needs

27. We believe the use of IT can help education meet these new needs in at least six significant ways:

Providing anywhere and anytime access to educational opportunities

28. IT can provide the means to access new educational opportunities from campus, schools, the work place, and homes. Making use of IT, it is now possible for the physically disadvantaged, those in remote locations, people whose schedules will not accommodate travel to a campus, and individuals who wish to access education programmes otherwise not available within their regions, to benefit

from IT-based educational programmes.

29. IT can make it possible for Hong Kong tertiary institutions to serve a global community of learners, for example helping doctors in remote locations in China learn about recent developments in Western medicine, providing businessmen in Europe with information about legal requirements and cultural considerations for conducting trade in Hong Kong, or enrolling overseas Chinese students in Canada in advanced degree programmes. Many of HKU's academic staff are already making use of the World Wide Web to deliver instructional materials to their students as well as to facilitate communication about classroom topics. Such uses will enhance communication among staff and students, encourage discussion among students, and make it possible for individuals on the Mainland and in other countries to benefit from our educational offerings.

Making the unimaginable possible

30. IT can bring into the learning experience that which was unimaginable only a few years ago. For example, architecture students making use of virtual reality systems can design and "walk" through structures before they are built, engineering students making use of 3D modeling software can "disassemble" entire buildings to better understand how various systems interact, geography students using GIS software can analyze satellite images to trace ancient trade routes, physics students can conduct virtual experiments that would otherwise be too expensive or dangerous, students in the fine arts can "tour" a distant museum or cathedral, students in atmospheric science can model a typhoon's behavior using scientific visualization software, and students across the disciplines can participate in electronic field trips to "virtually" visit remote locations .

31. At HKU, the History and Architecture Departments are collaborating on a project to build a multimedia database of historical Hong Kong building which have long since been demolished. This effort will enable our young people to "visit" such sites and learn about their historical importance as well as their physical appearance. They have already built virtual temples of China. Staff in the Faculty of Dentistry are making use of virtual reality technologies for teaching and our Zoology Department has created a virtual marine laboratory.

Supporting and encouraging sound pedagogy

32. IT can support traditional teaching methodologies like the large group lecture. However, it can also support new teaching methodologies. Instructors making use of interactive multimedia on CD-ROMs and websites, can engage students in self-paced, self-directed problem-based or constructivist learning experiences and also test student learning in new, interactive, and engaging ways that may better assess deep understanding of content and processes. An increasing number of high quality technology-based instructional materials are becoming available which support student-centred curricular approaches. In addition, academic staff and students can collaborate on constructing knowledge and developing technology-based materials.

33. Staff in the Pathology Department at HKU have developed multimedia tutorial software which students use to learn how to read slides of tissue for signs of disease and assess their understand. This locally developed software is in use in medical schools around the world. Staff in the HKU English Centre are developing a multimedia English pronunciation guide incorporating video, audio, and text-based learning activities which are self-paced and self-directed. Students in our Departmen of Comparative Literature are studying the developing "cyber" culture of the web and creating personal websites to reflect their understandings.

Creating new opportunities for collaboration

53. IT makes it possible to remove the barriers of distance and time and bring together people in "collaborative learning communities." No longer need a students' circle of peers, teachers, and mentors be limited to those available when he or she is on campus. Our young people can collaborate with students in other countries, consult teachers when not in class, and seek advice from mentors working in business, industry, and the professions as part of their normal practices.

54. Such work is already taking place at HKU in the Department of Architecture where teams of students from around the world compete in design contests making use of the World Wide Web and videoconferencing, and in Education where teacher educators from the University, student teachers, and sponsoring teachers in Hong Kong schools make use of *Virtual Learning Environment* software to stay in close communication about the students' learning progress.

Providing access to digital resources

55. Accessing, analyzing, understanding, and making use of information are central to the educational process. Historically, information resources at universities have been made available to students on-campus in a wide variety of physical media including printed works (e.g., textbooks, journals, illustrations, maps, charts and graphs), photographs, films and videotapes, paintings, models, and so forth. However, it is no longer necessary for students to be on campus and acquire a physical object in order to access information. Digital representations of such objects can now be made available to students at any time and from any place. The National Science Foundation in the U.S. has funded six major university projects to develop digital libraries encompassing all types of media. As previously mentioned, the Open Learning University (OLU) has issued a $40 million contract to the Hong Kong University of Science and Technology (HKUST) to develop a digital library for their students.

56. In addition to these efforts to create the libraries of the future, many new information resources (e.g., websites, digital images, electronic journals) are being created which can <u>only</u> be accessed electronically. As digital representations replace physical materials, it will be critical that our young people are prepared to make use of IT to access them.

57. At HKU, we are moving ahead with the transformation from physical artifacts to digital representations of resources. The HKU University Libraries catalog has

been available electronically for several years. We are now moving to full-text electronic databases of popular journals as well as exploring alternative delivery services to staff and our young people such as email and fax.

Better preparing today's students for the realities of tomorrow's workplace

58. After leaving the HKU to embark on a career, our young people can expect the day-to-day practice of every discipline represented in the nine HKU Faculties to be affected by the use of IT. Having advanced technology skills and knowing how to use discipline-specific applications will help them secure suitable employment and enhance their productivity once employed. Furthermore, the ability to engage in life-long learning opportunities offered by universities around the world are increasingly dependent upon access and use of such technologies.

59. At HKU we have recognized this reality and are moving ahead with curriculum reform efforts intended to enable academic staff and students in every discipline to make use of teaching methods and materials which take full advantage of access to computers, the network, and networked information.

IT and Tertiary Education

60. The most important principle governing efforts to incorporate IT in tertiary institutions should be that learning and teaching with appropriate pedagogy are primary and that technology is a means of supporting them--not an objective itself. To this end, the University Grants Committee has noted that the use of IT can significantly enhance tertiary education:

> "Technology will improve the quality and range of teaching and learning by providing:
>
> a. better access to information;
> b. more active learning as opposed to passive listening to lectures;
> c. more learning (and teaching) at times and places most convenient to students;
> d. more opportunities for collaborative learning (students working together on projects); and
> e. 'mass customization,' wherein technology-mediated learning experiences are tailored to individual students' needs." (UGC Report on Higher Education in Hong Kong, October 1996, par. 26.13)

61. We agree with this assessment but also agree with the UGC that such improvements "will require large investments in hardware, software, and externally-produced courseware, plus a considerable amount of institutional retooling" (par. 26.19). Below, we discuss some of the issues to be considered.

Infrastructure development

62. It will be necessary to expend significant resources to build the technology-rich learning environments necessary to incorporate IT use into teaching and learning. While the basic telecommunications "backbones" are in place in most of our tertiary institutions, access to this infrastructure is not always available within traditional educational venues such as lecture halls and classrooms nor from non-traditional venues such as student dormitory rooms, non-resident halls, student unions, and library study rooms. Nor or learning spaces designed to make possible such use. More computer laboratories are not the solution. We must rethink, redesign, refurbish, and rebuild our educational institutions from the ground up during the coming years to enable IT use across the curriculum and throughout the physical facilities. We recommend that the Government provide significant new resources for such endeavors.

Curriculum Reform

63. As mentioned previously, educational needs, along with research results which provide a better understanding of how learning takes place, are changing the nature of education. Problem, project, and case-based learning, cooperative learning, and constructivist teaching methods which incorporate student knowledge construction, critical thinking, and problem-solving are being incorporated into teaching and learning practices at universities around the world.

64. In order to benefit from such techniques, it will be necessary to rethink the curricula in all disciplines. IT can provide a means by which many of the principles contained within such pedagogical methods may be implemented including individualized, self-paced, and self-directed learning.

Staff Development and Incentives

65. In a recent article in Change Magazine, Dr. Alan Guskin noted, "The changes being asked of faculty members in restructuring their work lives will be extraordinary and will require them to function in ways they never conceived of and for which they were not trained."

66. These changes are being driven in some measure by rising student expectations as one HKU's staff member noted in a recent IT survey: "... our young people are becoming increasingly interested in and capable of using technologically-based learning materials. We will be left behind by them if we do not adapt our teaching methods to incorporate new technologies."

67. While we recognize that not all academic staff are interested in making use of IT, in fact that a few are hostile to such use, we believe that the majority are interested and will have at least four specific needs in terms of IT use. Academic staff need to: (1) use technology to support traditional and new teaching methods; (2) use and teach about discipline specific IT applications; (3) develop - or use externally produced - IT-based activities and materials; and, (4) use IT for professional purposes other than teaching such as accessing electronic journals and

participating in collaborative research projects with colleagues at other institutions.

68. Programmes need to be developed which support academic staff as they begin to learn about and use IT in their work. We believe such programmes should be driven by academic rather than technical goals; taught by academics rather than technicians.

69. Research into the diffusion of innovations has shown that innovations which are perceived by the target audience as having the following five characteristics are adopted more rapidly:

    • greater relative advantage;
    • compatibility with existing values, past experiences, and needs;
    • available for experimentation on a limited basis;
    • "observable," that is, the results of adoption by others may be seen; and
    • less complexity.

70. As we plan for the implementation of IT in tertiary institutions, opportunities to clearly demonstrate the advantages of its use to staff should be made available in a variety of ways including demonstrations, workshops, presentations, and site visits. In planning for technology implementation in classrooms, those applications which are compatible with academic staff values, past experiences, and needs are most likely to be adopted. IT developments will need to accommodate the way teachers actually work by providing applications which support ordinary practices such as communicating with our young people and colleagues, illustrating lectures, and conducting research. Teachers tend not only adopt an innovation but to adapt it to their particular teaching practices. This practice needs to be encouraged and channels developed so that the results of such reinvention may be shared.

71. Academic staff are also more likely to adopt an innovation with which they have had an opportunity to experiment. We must not, at first, have too high expectations for IT revolutionizing all classroom practices. Many innovations take years, even decades, before they become firmly entrenched into normal practices. However, all academic staff need to be given the opportunity to try out various uses of IT in their classrooms.

72. Observability is an important characteristic of innovations which are more likely to be adopted. That is to say, when an individual successfully adopts an innovation if others can see the results it has a major impact on the individual decision-making process. We should seek out early innovators with IT within our tertiary institutions and provide means by which they can share their experiences with their peers. IT can provide the means for these efforts as well. For example, the Learning Skills Unit at the University of Melbourne and the Learning Development Centre at UWS MacArthur have developed a prototype national/regional academic skills web site which aims to create a collaborative electronic environment in which academics can efficiently share in the creation of web-based resources and eliminate unnecessary redundancy of effort.

73. Complexity is the degree to which an innovation is thought to be difficult to understand and use. Ideas that are simpler to understand are adopted more rapidly. Note that this does not mean that complex or difficult to understand innovations cannot be disseminated. If this were the case, we would still be living a pre-industrial society. In terms of IT use, what it does mean is that training, support, and materials–such as software–need to be developed in such a way to increase ease of use and reduce complexity.

74. Although mass media like newspapers and television can provide information about an innovation, it is through interpersonal communications that the individual adoption decision is most likely to be influenced. Most people listen to their peers, people like themselves in similar situations with similar needs, who have previously adopted an innovation. Academic staff in our tertiary institutions can and should play a major role in introducing IT use to their colleagues and in helping them as they implement technology-based tools and methods into their courses. This task cannot be left to the technicians or computer vendors who often do not understand academia and, rightly or wrongly, have little credibility with academic staff. We must develop programmes which tap into the power of peer IT mentoring and provide opportunities for IT leadership to develop and flourish among our teachers.

75. Integrating IT into one's educational practices can be a difficult and time consuming task. The UGC has noted "that new guidelines and models for institutional policies and practices will need to be developed for the evaluation of staff who use technology. Similarly new guidelines will need to be formulated for peer review and evaluation of teaching, scholarship, and service that utilize information technology" (Higher Education in Hong Kong, Annex F of Report by the UGC, October 1996). We agree with this assessment. In light of our previous comments about the importance of academic staff leadership in IT implementation, this is even more critical. We need to give credit for innovations with IT in the retention, tenure, and promotion process, as well as considering IT credentials when hiring new staff.

Technology-based Materials Development and Adoption

76. The fusion of technologies and tools for combining text, illustrations, photographs, sound, voice, animations, and video and providing access to these products over computer networks has created both "new media" (e.g. the WWW, multimedia CD-ROMs, computer-mediated communications) and a new digital industry that merges several traditional industries (i.e., publishing, computer, broadcasting, entertainment, and telephone industries).

77. These developments have made it possible to provide high quality, effective "anywhere, anytime" educational opportunities to our young people. The development of high quality new media learning materials requires interdisciplinary teams of people working collaboratively combining traditional and modern skills, e.g., content expertise, computer programming, interactive

design and authoring, desktop publishing, digital graphic design and illustration, instructional design, web page and web site design, web management, three-dimensional modeling, animation and visualization, virtual reality development, digital photography/image processing, digital film/video production, and digital audio/music production.

78. As might be expected, the development of New Media also requires a good deal of expense hardware and software including digital editing systems, image processing software, high speed workstations, image databases, authoring packages, digital video servers, scanners, disk storage arrays, and so forth.

79. Most academic staff cannot be expected to become expert in all of the areas necessary to develop high quality technology-based materials nor can each department afford development hardware and software. Keeping abreast of their disciplines, working with our young people, assisting with university functions, and conducting research keeps them quite busy.

80. One solution to this problem, as the UGC has recommended, is the adoption of externally-produced courseware. However, it is difficult for academic staff to locate information about such courseware or to find unbiased, reliable evaluations of its effectiveness written by other academics. We recommend that the Government provide resources for the establishment of an on-line clearinghouse of information about commercially available courseware and, on each campus, a demonstration centre where materials produced by educational vendors may be evaluated and made available for demonstrations and trial use.

81. Another solution to the problems identified above is the creation of "New Media" centres on Hong Kong university campuses. Such centres are springing up at tertiary institutions world-wide. Stanford has established the Stanford Learning Laboratory, MIT has just announced the creation of Media Lab II which will focus on educational applications, and in 1993 an alliance of technology and publishing companies and participating universities founded "The New Media Centre Consortium." There are now more than 75 universities participating in this programme including Columbia, Cornell, Northwestern, and the University of Michigan in the U.S.A., as well as schools in other countries including Finland, Canada, Australia, Colombia, and Taiwan. Commercial partners include Adobe Systems Incorporated, Apple Computer, Inc., FWB Inc., Macromedia, Prentice Hall, Sony Electronics Inc., and SuperMac Technology, Inc.

82. A New Media Centre can provide a central point for educational IT initiatives on campus, coordination of research and development efforts, a liaison with commercial vendors, and also serve as a demonstration centre. More to the point, a New Media Centre can also house a multimedia development team and expensive production hardware and software. In such an environment, academic staff can work with the multimedia development team proposing ideas for materials and providing content and teaching expertise. The development team, consisting of individuals with the skill-sets noted above, can rapidly, efficiently, and in a more cost-effective manner create the needed materials. Materials created in a New Media Centre at one Hong Kong tertiary institution can be made

available to them all. Such professionally produced efforts could also lead to commercialization of locally produced educational materials thereby creating a revenue stream for the university and academic staff. Such a Centre could also develop and offer programmes for students in New Media development and management.

83. We recommend that the government, working with the IT industry, sponsor the creation of one or more New Media Centres at tertiary institutions in Hong Kong for these purposes.

Student Training and Equipment

84. We may anticipate that in the future, because of the government's new IT Five-Year Education Strategy, that our young people will arrive on campus with adequate IT skills. At the moment such is not the case as is illustrated in a recent article by Dr. Peter Cunich, Department of History in *Teaching Matters*, a publication of HKU's Centre for the Advancement of University Teaching (CAUT):

> " An entry survey of our first-year our young people revealed that while 82% of them had access to a computer at home, less than half had ever used those home computers for anything more than playing electronic games. Only 18% had used e-mail or the World Wide Web before arriving at HKU. Three weeks after the beginning of the first semester an encouraging 80% of our young people had visited the Computer Centre and 64% of them were aware that they had access to e-mail, but still only 39% had actually sent an e-mail message. More worrying was the fact that only 54% of them had used the Library's Dragon OPAC system. But for us the most disappointing result of the survey was to discover that a mere 25% had used the World Wide Web since arriving at the university. It was therefore clear to us that we would have to teach the our young people how to use the Web before we could employ it as a medium for delivering CAI. "

85. In order to develop and use their IT skills, our young people must have training, access to equipment, and access to the campus network and the Internet.

86. We feel strongly that instruction and use of IT must be integrated into and across the curricula. We believe any approach which would separate IT instruction from authentic learning experiences and create a separate IT curriculum is wrong-headed. Our young people need to learn to use IT in the context of their normal academic experiences, not as a separate subject. Any instruction in specific software or hardware operation can be accomplished via on-line tutorials, within existing courses, by short term workshops, or by peer tutoring. We recommend that Hong Kong's tertiary institutions cooperate on the development of such on-line tutorials, training, and help services.

87. Student access to computers is a problem which has plagued universities for years. The traditional approach has been to create so-called "open access" computer

laboratories. Such laboratories are expensive to build, operate, staff, and maintain. And they seldom provide sufficient or timely access to computing resources for all our young people. In light of these difficulties, especially at Hong Kong tertiary institutions where space is at a premium, other possibilities need to be explored. The simplest solution would be for every student to have his or her own computer. We encourage the Government to initiate programmes which will make this possible for all our young people, regardless of their family's income level. Subsidy programmes, loans, leasing arrangements, special discounts for volume purchasing, so-called "buy-back" programmes, and other creative approaches should be investigated with the goal that every incoming tertiary student in Hong Kong own a personal computer. In addition, we encourage the Government to solicit innovative solutions from tertiary staff and the commercial sector for technical support and training services. Many such services now provided by university staff might better be "outsourced" to commercial vendors. Such solutions may be more effective and less expensive.

88. Network access is critical if our young people are to make use of the power of digitally-mediated education and access to on-line resources. The situation at the moment for most of our young people is that access is only possible from workstations located in campus laboratories. In our vision of the future campus, any student will be able to access the network from any campus location, whether in the library, dorm rooms, classrooms, lecture halls, non-residential halls, or the student union building. Our young people should be able to connect to the network at the time that they need to. To offer an analogy, of how much educational value would textbooks be if they were only available at certain times of the day, on a limited number of days of the week, from a few campus locations, and even then had to share the textbooks with other students?

89. To realize this vision of ubiquitous network access, it will be necessary to investigate various technologies such as dynamic IP addressing, packet radio, and virtual LANs. It will also be necessary to rethink how teaching and learning take place if a computer and network connection are readily available all of the time in any campus location. We recommend that the Government endorse this vision of the campus of the future and provide resources to develop and implement the most cost-effective, high speed, ubiquitous system of network connectivity possible at all Hong Kong tertiary institutions.

On-line Information Resources

90. Operating an enterprise as large as a university requires large amounts of information be stored and exchanged among thousands of administrators, staff, and our young people. Although universities have traditionally made use of electronic information systems to facilitate information flow, much more could be done to make such systems more comprehensive and user-friendly. Services such as on-line registration and application for financial assistance should be common. Comprehensive electronic databases of information about university policy, regulations, and programmes should be available on-line. Services such as scheduling meetings, reserving classrooms, requesting maintenance, and so forth should be automated.

91. Creative uses of on-line services in support of our young people at tertiary institutions, like those being developed in other tertiary institutions, should be devised in Hong Kong. For example, the University of California at Los Angeles (UCLA) has made available a system which can automatically create a personal Web page for any of the university's 30,000 students who requests one. This new system can also automatically link to materials geared to the student's interests. The system takes advantage of the enormous amount of information about students and university activities which are already stored on the campus network. For example the system "knows" all students' course schedules and how close they are to graduation, whether or not they are in the honors program, and can display this information as part of each student's webpage. Meanwhile, the university's Web server contains abundant information about course requirements, campus policies, and forthcoming deadlines.

IT and the University of Hong Kong

92. In an era increasingly dependent upon electronic information flow for social, economic, and political purposes, access to and knowledge of how to use IT for learning is an essential component of a comprehensive education. HKU and the other tertiary institutions in Hong Kong must move forward in this area if our young people and academics are to thrive.

93. Underpinning our vision of the future of tertiary education and recommendations is the fundamental belief that IT should serve as a means to achieve educational goals in tertiary institutions. The most important principle governing efforts to incorporate IT at HKU will be that learning and teaching with appropriate pedagogy are primary. IT is a means of supporting them--not an objective itself.

94. Neil L. Rudenstine, President of Harvard University, said in a recent issue of the Chronicle of Higher Education, "The cluster of technologies that we know as the Internet powerfully reinforces and extends some of the most effective traditional forms of university teaching and learning. On many campuses, it is already having an impact more dynamic and pervasive than that of any previous breakthrough in information technology during this century. And the transformation in progress is only beginning to unfold." We agree with this assessment of the powerful educational potential of IT and are working to make the benefits of IT use available to all HKU staff and students.

95. At HKU, we have been engaged in a strategic planning process for IT implementation for the past year. In November 1996, Professor Y.C. Cheng, Vice-Chancellor of the University of Hong Kong formed an ad hoc group "to consider the impact of technologies on learning and to advise the Vice-Chancellor on broad strategy and policy in respect to the implementation of learning technologies in the University."

96. This Group conducted a survey of HKU academic staff to identify factors which enable or inhibit the use of learning technologies at the University of Hong Kong.

Survey results can be viewed on the World Wide Web (http://147.8.151.101/Academic_Staff_Survey.html). Of the 25% who responded, 85% indicated that they were either using IT or were interested in doing so. The Group also prepared a progress report, developed as an interactive website (http://nt.media.hku.hk), and in June, 1997, presented it final report containing 11 principles to guide further IT planning at the University as well as eight recommendations for how the use of IT could be facilitated. The members of the Ad Hoc Group believed strongly that the University can *and should* become a leader in the development and application of technology to teaching and learning with the goals of enhancing, improving, and extending the reach of HKU's educational programmes.

97. To continue the planning process, in the Fall of 1997 the University formed an IT and Teaching Task Force which serves an advisory function and may also play some coordinating role during the implementation process. HKU recently announced that in September 1998, every incoming undergraduate student will be given the opportunity to have a personal lap-top computer to facilitate learning with on-line access and other information technologies. The Task Force is currently working on a comprehensive set of plans and recommendations for how this far-sighted policy can be smoothly implemented and adequately supported.

98. Once the strategic planning and consultation processes have been completed, we intend to move forward to create at HKU a new digital campus environment with technology-rich teaching and learning opportunities for all of our staff and young people. We are unequivocally committed to the development of the information literacy of students and staff so that they may excel in their scholarly pursuits, prosper in their chosen professions, benefit from lifelong learning opportunities, and make a positive contribution to Hong Kong society now and into the next century.

99. We recognize that there are many obstacles to the use of IT to improve teaching, learning, and research, not the least of which is costs. But, as the UGC has observed, failure to respond to the opportunities and challenges of IT will most assuredly side-line Hong Kong's tertiary institutions as developments proceed apace elsewhere. We have resolved that this will not happen at HKU, and we welcome the Chief Executive's initiatives in support of IT developments.

100. There are many important issues not addressed within this report, such as retraining of the workforce to make use of IT, government-sponsored R&D in the commercial sector, intellectual property rights, privacy issues, accountability, and the development of an integrated information system among social services, education, and the health sectors of our society. Much multi-disciplinary research remains to be done on IT. The process of implementation of IT will result in many societal changes, some of which will be painful. Consequences, both intended and unintended, are sure to result from the Government's new IT initiatives. We believe that Hong Kong's tertiary institutions can and should play a major role in IT research, development, monitoring of implementations, and in the continuing debate about policy.

November 1997