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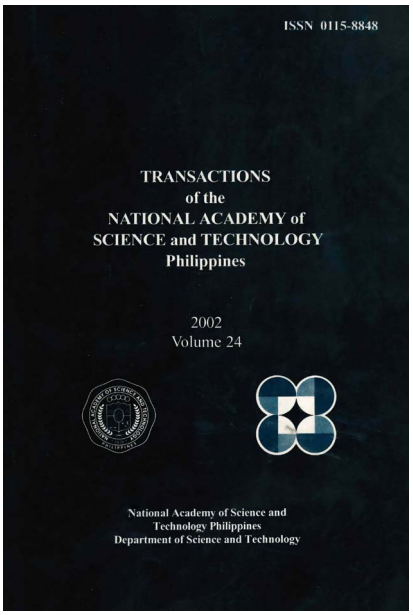

Enhancing Philippine Science and Technology Through ICT: An Overview

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ENHANCING PHILIPPINE SCIENCE AND TECHNOLOGY THROUGH ICT: AN OVERVIEW

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ABSTRACT

This paper discusses how information and communication technologies (ICT) can become pivotal tools for advancing Philippines Science and Technology. It discusses how ICT impacts the processes for advancing Science and Technology, and the importance of improving digital literacy. The emerging Peer-to-Peer computing model is briefly reviewed and examples of its opportunity for use in advancing science and technology are provided. The paper also discusses the Careerspace initiative in Europe for wide scale improvement ICT skills to improve European Competitiveness. The paper concludes with some observations in summary.

Keywords: ICT, digital literacy, Peer-to-Peer computing model, eLearning, globalization

INTRODUCTION

We live in an uncertain age, with the shape of society changing from being resource-based to being more knowledge-based. The well known management guru Peter Drucker says "In today's economy, the most important resource is no longer labour, capital or land; it is knowledge." Whilst this is a statement over which one could have much discussion and argument, it is clear that the creation and sharing of knowledge is a key modulator in the progression of an economy and indeed a society.

Looking back in history, the invention of the printing press and the establishment of postal systems were inflection points in the ability to create and share knowledge – the arrival of these "technologies" significantly moved global "knowledge" further. These two technologies are earlier pre-cursors of Information and Communications Technologies. Mankind continued to look at finding ways of better communicating at a distance, and ways of enhancing his natural skills in maintaining and processing information. Real progress began with mechanical solutions for railway signalling systems and for the first calculators. Ultimately the potential for purely mechanical technologies for use in more complex ICT applications turned out to be rather limited. The next major step forward in these technologies came with the use of electricity. Electro-mechanics, discrete electronics and finally microelectronics allowed the creation of far more complex and sophisticated systems for generating, transmitting, storing and processing information. Knowledge creation and transfer has speeded up and now we are able to process computer instructions at speeds of greater than 2 GHZ and transfer messages at the speed of light. In fact recently Intel demonstrated experimental silicon processing at a speed of 10 GHz, which is an indicator that we can expect this acceleration to continue. The information revolution is being driven by Moore's Law, which predicts a doubling of processing capacity every eighteen months with an accompanying cost reduction. This means that more and more computing power in PC's is becoming available at lower cost. ICT Technologies, used by small minorities just a few years ago, are now offering easily accessible on-line facilities to an incredible number of people.

A consequence of the globalization and uncertain times is that today's Philippine workforce and students face unprecedented challenges and competitive pressures. Academics and employees need to learn faster and colleagues often need to collaborate cross-functionally, across offices and borders to create new research, products and achieve operational excellence.

In parallel, information technology is creating new value propositions, which can help universities and businesses solve these problems. For example, Knowledge Management software can help corporation's and universities to share and leverage knowledge better. New eLearning software can deliver training efficiently and just in time, whilst also delivering it with greater fidelity. The combination of motivated knowledge workers and applied information technology is creating what might be called bionic organizations—organizations that deliver turbocharged output, with the whole significantly greater than the sum of the parts.

Advancing Science and Technology through ICT

As ICT becomes more prominent, it could be said that IT infrastructure and products and services are the air that modern day economies breathe. There are many factors that affect the advancement of science and technology; key variables include knowledge, skills, motivation, productivity tools and collaborative friction.

Rate of Advancement = function of (Knowledge, Skills, Motivation, Productivity Tools, (1 – Collaborative friction) and other relevant factors).

As economies shift from being more resource based to knowledge based, ICT is having an increasing impact on the ability to advance science and technology. One could argue that there two main impacts of ICT,

- *the ability of researchers, employees and students to use ICT skills* and
- the impact ICT has on the core value processes for advancing science and technology

In this context, researcher and employees must have the right knowledge and skills to perform their jobs and they must have the ability to share and leverage knowledge easily. Students and employees need to be able to learn quickly and skills just in time. A secondary factor is that researchers and employees are often motivated by having access to the latest information and communications products. Geographic and time zone separation are barriers, which create collaborative friction. Leo Ellis captures a good example of low collaborative friction in his quote *"Engineers have yet to devise a better inter-office communication system than the water cooler."* In many instances application of information technology is used in an attempt to reduce organizational collaborative friction.

Taking some poetic license with the Physics definition of Linear Momentum, being the product of Mass by Velocity, one could argue that the momentum of a research community or indeed an economy is somehow related to the product of the size of the population and the learning velocity. I define Learning velocity or knowledge velocity as the directional speed with which knowledge is flowing and people are learning. One could define the different types of knowledge as explicit, tacit and latent and ICT can directly impact the effectiveness of learning processes and accelerate knowledge flow.

Recognising the importance of knowledge, Intel developed an internal product, Intel ® Knowledge Sharing Software (Intel ® KSS) which was based on peer-to-peer computing software, Intel ® Content Distribution Software (Intel ® CDS). The goal of this solution was to solve multiple knowledge process problems using a single solution. Today Intel ® KSS is used at Intel for a number of knowledge processes – e.g. eLearning, Rich Content Communications and Distributed Knowledge repositories. As computing and communication technologies advance, the use of rich content is becoming more and more viable – Rich content uses technology to blend text, graphics, motion and sound to deliver information and knowledge, in a form that enhances understanding and retention by providing context and emphasis. It can also deliver a near face-to-face experience remotely.

The advantage of such solutions is that they do not need to rely on an advanced high public telecommunications infrastructure. Intel ® CDS takes advantage of high performance PC's and delivers large files quickly while providing

opportunities for network cost reduction. In effect these types of applications substitute less expensive processing power for expensive wide-area networking.

Intel ® KSS is an example of a peer-to-peer computing solution which is a very promising computing model whose time has now arrived. At technical definition is that Peer-to-Peer computing is simply the sharing of resources between computers – these resources could be computing cycles, disk space or even network bandwidth. Peer-to-Peer is a particularly attractive computing model for advancing Science and Technology. Often the use of P2P can enable faster results at lower cost. A great example of this is the Intel Philanthropic P2P Computing Program "CURE", whose goal is to use spare-computing cycles on millions of PC's worldwide to solve difficult problems like finding a cure for cancer.

CURE Peer-to-Peer Computing Program

As a first step in finding new drugs and a potential cure for leukaemia, the No. 1 cause of childhood death by disease, researchers began evaluating the cancer-fighting potential of hundreds of millions of molecules. Scientists estimated that this task required a minimum 24 million hours of number crunching, which was previously unimaginable. Intel with partners, United Devices Inc, Oxford University and the US National Foundation for Cancer Research announced a philanthropic peer-to-peer computing program called CURE to tackle this task. The initial Cure drug-optimization program evaluated four proteins. One of the four proteins had been identified as critical to the growth of leukaemia; and shutting it down could lead to a potential cure.

The research results for the first Cure program were promising with about 40,000 potential drug molecules found for one protein and about 20,000 potential drug molecules found for a second protein. In terms of processing work the distributed computing platform was screening more than 15,000 molecules per second: In comparison Pharmaceutical companies are typically screening a few hundred a week, although those results would be more accurate.

From a computing perspective it was projected that the CURE program would yield a "virtual supercomputer" which would ultimately be capable of more than 50 teraflops (trillions of operations per second) of computational power and involve millions of participants. At the end of 2001 there one million, three hundred thousand PC's signed up to the CURE program. At this time the program had produced over 81,000 years of computation and 70 teraflops of computational power. By any standard the level of computation power is staggering, allowing acceleration of time to a cure at a vastly reduced price for computing capacity.

Craig Barrett, president and chief executive officer of Intel Corporation says "Intel and the scientific community are using the PC and the power of peer-to-peer computing technology to dramatically change the way medical research is performed – By harnessing Internet-connected PCs, this project will enable, what could be, the largest biological computational capability in history to help solve some of the most difficult scientific problems." That would be a wonderful achievement.

Intel itself is using peer-to-peer computing to do advanced design for our new microprocessors. A solution called Intel ® Distributed Computing Platform allows us to run design jobs on idle computing capacity worldwide, ensuring products get to market faster, whilst keeping the cost of computing capacity affordable.

Wireless Technologies are improving and will offer connectivity at greatly reduced pricing. The migration from circuit switched to packet switched operation of wireless networks will enable significant economies of scale and speed improvement. Rapid deployment of wireless and cellular technology will improve mobility and the opportunity to do research anytime, anyplace, anywhere.

ICT Skills and the Research Community

The depth and breadth of ICT skills penetration in the Philippines society will be an important factor in future success. Looking towards Europe, this has been recognized and a unique collaboration between the European Commission and private industry, in the shape of the Careerspace Consortium has been formed to improve the quality of ICT skills and drive further penetration of ICT skills. The Lisbon European Council of 23 and 24 March 2000 set the European Union a major strategic goal for the next decade "to become the most competitive and dynamic knowledge based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion."

The Council recognised that there is a widening skills gap, especially in information technology where increasing numbers of jobs remain unfilled and at the same time acknowledged that "every citizen must be equipped with the skills needed to live and work in this new information society."

To attain this strategic objective, the European Council called inter alia, for Europe's education and training systems to be adapted both to the demands of the knowledge society and to the need for an improved level and quality of employment.

The Information and Communications Technology (ICT) industry in Europe, which is acknowledged as the driving force of the new economy supported this call and is playing an active role in partnership with all stakeholders to achieve this strategic objective. The Careerspace Consortium is led by Intel, IBM, Nokia, Philips, Siemens, Telefonica, Cisco, Thales, Nortel and is funded by these companies and the European Commission.

Working with 20 universities across Europe, the Consortium has developed new Information and Communication Technologies (ICT) curricula, matched to the needs of the 21st century. These new curricula will hopefully become the European benchmark and are providing the basis for evolutionising ICT education across Europe.

Yet business and social opportunities in Europe are at risk due to ICT skills shortages – with unfilled vacancies estimated to reach 1.7 million by 2003 (Source: IDC 2000). Hence an important other strand of the Consortium's work is to attract

more people, especially women and people with disabilities, to develop ICT skills. A significant marketing effort, centred on a website www.careerspace.com is underway to attract more people, especially women into the ICT industry. As Careerspace moves into its third phase there is increasing emphasis on vocational ICT training and generation of profiles for users in generic industries.

The Philippines may already have similar initiatives in place ; if not, the country should strongly consider such initiatives. Only through such initiatives can the emergence of the so-called Digital divide be minimized and in it's place the creation of a digital dividend be established.

CONCLUSION

ICT is a major force in the global economy. Societies have the choice of being proactive or reactive in the face of this wave of change. The Philippine status as the world's largest user of SMS technology shows an affinity for technology adoption – if this can be harnessed and directed, then the potential will be amazing. Adoption of peer-to-peer technology for knowledge sharing/eLearning or for accelerating research results can enhance knowledge sharing and creation whilst the adoption of wireless technology can overcome barriers imposed by physical infrastructure.

Strategy impacts Destiny– proactive use of ICT can significantly advance Science and Technology. As James Allen in his book "As a Man Thinketh" states "Dream lofty dreams and as you dream so shall you become" (Allen, 1992).

REFERENCE

James Allen. 1992. As a Man Thinketh, Barnes and Noble Inc.