ICT for Development in Asia Pacific: Emerging Themes in a Diverse Region

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In late 2008, a series of financial shocks highlighted the risks emerging from a highly networked, information economy. Governments were forced to respond quickly as movements in one financial market overnight had unpredictable effects on investor confidence in the other side of the world the next day. While investment banks collapsed or were bailed out, governments were forced to underwrite individual deposits, and reluctantly admitted that there was little that could be done to decisively reverse their nation's market fortunes or insulate them from the radical volatility of advanced economies. When advanced economies such as the United Kingdom have over 60 percent of their wealth in real estate (Hopkins 2008), sudden write-downs in value can occur as property markets fall.

It was a reminder, perhaps, that the question of development in the networked economy is far from straightforward, and the issue of wealth acquisition requires developing economies to ask: what kind of wealth? Many commentators assume that because information and communication technologies (ICTs) are equated with higher overall standards of living, then the deployment of these technologies and associated infrastructure will automatically result in higher levels of development. However, a historical view suggests that when disruptive technologies such as the Internet emerge, it is those with substantial capital who are best placed to reap the dividends (Noe and Parker 2005), and in a networked economy, this usually means those in advanced economies.

A focus on human rather than purely technological development is becoming evident from governments in the Asia Pacific region, with the aim of making the labour force globally competitive in the ICT and related industries. Localization is a key strategy in ensuring that productive workforces are retained and developed, as this workforce becomes the most strategic asset in responding to a rapidly shifting information economy.

WHAT DO WE MEAN BY ICTD?

The field of Information and Communication Technology for Development (ICTD) now includes a vast variety of projects with many different aims and objectives. When we look at the path traveled by the term "ICT" in recent years, its expanded coverage should come as no surprise. "Information" - or structured data - is now widely recognized as central to economic production. Even traditional business sectors such as agriculture are increasingly reliant on human information interventions such as the genetic modification of crops or classification systems for produce. Communication technologies are a key factor in these developments as they are the means by which information is stored and circulated. ICTs are the transportation networks of the information economy, and their exponential growth and diversification are well documented in recent reports (United Nations Economic and Social Commission for Western Asia 2005).
"Development" itself is a term with many competing definitions. Most policymakers focus on macroeconomic growth as a key indicator of development; social entrepreneurs like Muhammad Yunus of the Grameen Bank emphasize access to credit and business development; and economists such as Amartya Sen (1999, p. 10) describe development in the holistic terms of personal freedom, noting that economic gains are not the only measure of effective development and that we must also examine the state's role in helping to provide: "(1) political freedoms, (2) economic facilities, (3) social opportunities, (4) transparency guarantees and (5) protective security". Recently, trends toward measuring and valuing development include a collective dimension outside the nation-state and the individual citizen, encompassing collective cultural development of indigenous groups (Coombe 2003) and the natural environments that support people's lives. These various aspects of development are sometimes in conflict with each other, making the terrain of development, and ICTD, a complex political field.

Increasingly, development is linked to sustainability, as economic development has often involved the use of finite natural resources and short-term economic growth may result in fewer opportunities for development in the future. Elina Zicmane (2004, pp. 8-10) notes that the European Commission defines sustainable development as "development in which present generations find ways to satisfy their needs without compromising the chances of future generations to satisfy their needs". She notes that a common analytical framework is the "4D" interpretation, which looks at four dimensions of sustainable development: ecological, economic, social, and cultural. "Regardless of a separate definition of each dimension," she says, "all four of them are strongly linked and require a cross-cutting approach." ('sustainability" is discussed further later in this chapter.)

So it would be a brave person who would propose a succinct overall definition of development. However, development aspirations become clearer when we move toward the actual impact of development activities on the ground: human development. The United Nations" Millennium Development Goals (MDGs) give development this pragmatic lens, emphasizing the eradication of extreme poverty and hunger; universal primary education; gender equality; the reduction of child mortality; maternal health; combating HIV/AIDS, malaria and other diseases; environmental sustainability; and a global partnership for development.

The role of ICTs in addressing the most pressing concerns of the least developed territories is far from clear. However, we believe that in looking closely at how various technological initiatives are taking shape on the ground, we can gain a better understanding of the opportunities and risks of ICTD activities. In this respect, the Asia Pacific region provides a rich testing ground with both important success stories and instructive failures.

In this overview chapter, we outline some key concepts that are useful for considering contemporary ICTD initiatives in the region, to assist the reader in analyzing and evaluating the other chapters in this edition of the Digital Review of Asia Pacific. We also discuss initiatives and themes gathered from the Digital Review authors" meeting in Singapore in March 2008 where 50 experts from the region shared their views. Greater detail on policy initiatives can be found in the overview chapter on ICT regulatory
approaches and detail on specific initiatives will be found in the chapters on individual economies.

ICTD: THE STATE OF THE ART

An important part of the Digital Review of Asia Pacific is to develop more specific and nuanced scenarios of ICTD. Therefore, we must critically address the expectations of ICTD. By "critically" we do not mean "negatively", but simply in a manner that questions assumptions that are not matched to lived experiences on the ground. In particular, as Richard Heeks (2007, p. 1) notes, "Very little work to date has drawn from the D of ICT4D - linking concepts in development studies to this research domain." Our aim here is to avoid the technocratic or economistic approaches often associated with ICTD discourse from an informatics background, and to keep the people-centred view of development at the centre of our analysis.

Anita Gurumurthy and Parminder Jeet Singh (2006, p. 18) trace the idea of ICTD back to the Digital Opportunities Initiative (DOI) report authored by the US-based consulting firm Accenture, the US-based non-profit Markle Foundation, and the United Nations Development Programme (UNDP) in 2001. This report "developed some key concepts of what came to be known as ICT4D, and… form(s) the basic framework of ICT4D thinking even today". The view of development that the DOI report projected was market-oriented and saw development mostly in terms of dominant economic growth paradigms that have come from the developed world.1 However, the concept of ICTD probably emerges most clearly from the first Global Knowledge conference held in Toronto in 1997 by the World Bank and the Canadian government. While international agencies such as the United Nations Educational, Scientific and Cultural Organization (UNESCO) have been acting in this field since the "MacBride Report" of 1980, ICTD galvanizes a new understanding about the links between communication and economic development that departs from a "cultural" model.

As ICTD matures as a field, a number of reviews of ICTD literature that question some assumptions and embedded world-views are beginning to appear (see, for example, Ekdahl and Trojer 2002; Wilson 2002). A key issue is that the way that ICTs are conceived has a big impact on the efficiency of development projects, and the views of ICTs of policymakers and practitioners on the ground are often different.

In particular, three "articles of faith" identified in ICTD must be questioned if we are to learn from the work of others and not simply promote what ethnographer Eric Michaels (1990, p. 20) described as ineffective but well-meaning advancement projects, "the discarded skeletons of which litter the countryside". First, metaphors of catch-up, progress, and leapfrogging in the ICTD literature present development as a linear pathway. ICT is seen as a positive, or at least neutral, influence on progression along this pathway. Second, there are common demands for urgency and the need to act quickly on ICTD in order not to be excluded from fast-paced developments. This advocacy of urgency persists even though the ranking of national human development indicators listed in the UN Human Development Reports remain remarkably stable over time. Third, assumptions are made
about what kinds of information are valuable for development through the creation of the category of "information-poor" peoples who are compared to the knowledge-holders of the developed world rather than viewed in terms drawn from their own experience.

Taking a human development and human rights perspective, we counter that no nation is inherently underdeveloped socially, culturally, and environmentally. While ICTs often drive standardization and interoperability, we cannot assume that, for example, the speakers of over 800 languages spoken in Papua New Guinea "lack information" when their languages are not represented online (Gordon 2005). They would not necessarily benefit from a single language. It makes more sense to say that text-oriented ICTs such as the Internet are currently incompatible with many large bodies of information, particularly those held in non-dominant language groups. Rather than the deficit model common in the modernization development discourse, a more responsive approach in ICTD will mean that the socio-cultural development of peoples in their cultural environment will be given serious consideration as an opportunity for thinking about the future possibilities of ICTs.

Sein and Harindranath (2004) note that many donors and project sponsors see ICT as purely a tool for technical use, but more sophisticated projects attend to what ICTs represent or mean for users and the way this fits into the larger context of their aspirations. They see a number of different use strategies for ICTs - as a commodity, as a support for development activities, or as a driver of economic transformation - that need to be evaluated differently (Sein and Harindranath 2004, p. 20). They note that the impact can range from simple substitution of one practice for an (hopefully more efficient) ICT-enabled one, to a growth in desirable phenomena occurring because of ICTs, through to the emergence of new structures due to ICTs. These are different orders of impact, and the risk and consequences grow as higher-order change is attempted. It goes without saying that wholesale economic transformation is unlikely to occur due to a single ICTD project. ICTs are not a single neutral technology, but a complex field of activity encompassing many different technologies and various types of information that existed prior to these technologies coming into being. As Gunnar Swanson (1994) suggests about design, ICTs are 'syncretic and integrative" - they combine existing information in ways that are new, yet also reflect prior modes of economic and social life. ICTs are not in a place that people move to from their pre-ICT world, but are a complex set of systems and protocols that link people together. ICTs are fundamentally relational.

Gayatri Chakravorty Spivak (1987), discussing ICT-enabled markets as presented in the US media, made this case very plainly more than two decades ago. She noted that while capital investors such as the Lehman Brothers are described as being able to, thanks to computers, earn "about USD 2 million for ... 15 minutes of work", this economic story writes itself upon another where "a woman in Sri Lanka has to work 2,287 minutes to buy a T-shirt". For Spivak, the developed economy is not a more advanced version of an underdeveloped one: they are linked through the technologically-assisted movement of people, labour, and finance capital, and the respective interests of these economies may not only be different but sometimes antagonistic. One aim of this chapter is to make clearer the differential impacts of ICTs for economically developing communities.
**Globalization and Migration** It is well known that ICTs not only increase the flow of materials, products, and information through communications networks, but also facilitate greater human mobility. This human movement creates challenges for regional economic development, as it is not always clear how the benefits of ICT will remain in a local area or even a nation when they enhance the flow of talented humans away from communities. In some ways, our conception of ICTD is bound in this tension around a future that is "global", enticing people to become more mobile, and at the same time attempting to be an impetus for benefits in local communities. This tension leads to confused planning about the actual results of ICTD initiatives.

Jeb Brugmann (2002) notes that most cities remain victims to four 'strategic flaws" that reduce the capability for sustainable development and these are particularly noticeable when looking at ICTD compared to other development initiatives. First, we tend to focus on the future rather than on strengthening existing capability.

Second, we usually attempt to avoid, rather than to address, our conspicuous institutional and political issues. Third, we tend to forget that our strategic position is also a product of routine practices and incremental decisions rather than somewhere we "choose" to be. And fourth, as a combination of the other three, we tend to treat the market as a measure of development rather than as a tool to enhance well-being.

These suggestions encourage us to look closer at the context of development, particularly in underdeveloped regions, and to unlock the potential for sustainable development in less revolutionary but more effective measures based on existing capacity and capability. In most regions, the rural poor are the most targeted in development programs, and addressing the social and economic issues they face will require interventions in the agricultural economy. The potential for ICT interventions is not so much to allow entry into a new economy, but to enable families to have access to health information and capital and to take better advantage of remittance economies (Richardson 2006, p. 8). As Richardson notes, the end goal of these ICT interventions is not improved agricultural production, but "poverty reduction in the context of improved livelihoods, recognising the clear importance of the rural family as the hub of agricultural production in areas of poverty, and within national economies" (Richardson 2006, p. 9).

Ironically, by focusing on the rural family in underdeveloped areas, the degree to which local development involves global issues becomes clear. For example, remittance economies are crucial throughout the Asia Pacific region, and are radically underestimated by analyses that account only for official channels of economic trade. As Seddon et al. (2002) note, the majority of remittances are "informal or illegal" and between 13 and 25 percent of Nepal's Gross Domestic Product (GDP) is attributable to remittances from abroad. As the bulk of the work undertaken by families abroad is service work, the remittance economy relies to a large extent on ICT skills, whether such skills are used directly in employment or as a means of connecting to a wider economic infrastructure in a host community where a migrant worker will travel.

Remittances are a very specific way in which underdeveloped communities make use of
global networks, and their often informal nature should not prevent ICTD initiatives from supporting these inward flows of resources. However, supporting such family-led redistribution of resources involves less work on high-level global economy issues such as free-trade agreements that support capital mobility, and more attention to difficult political questions such as labour force mobility within and between countries.

**Evaluating Gender in ICTD** Gender constitutes an increasingly important dimension of evaluation in ICTD projects. Rural economic development relies on women, who make up two-thirds of the economic activity in agricultural areas. For this reason, an understanding of gender issues is essential for effective implementation of ICTD projects. The gap between the leadership role of women in rural areas and the gender gap in ICT leadership where women lag behind creates negative impacts within the communities that ICTD seeks to assist. The bias of ICTD toward technological, global discourse means that issues relating to families and their holistic development are sidelined, even though ICTs are often central to family life and readily used by women. This is an important opportunity for the ICTD community to address.

Initiatives such as the Association for Progressive Communication's Gender Evaluation Methodology (GEM) highlight the importance of women's experience as an analytic tool. They also identify strategies for intervention at the policy and project evaluation level. There are three questions the tool asks as a starting point for analyzing gender components (Ramilo and Cinco 2005, p. 82):

1. Was there a discussion of gender issues in the project planning phase?
2. What assumptions were made or research done on how ICTs can facilitate change for women and men?
3. How were women or groups of women identified in the project?

These questions help clarify that gender cannot be an add-on for ICTD or relevant only to projects for women, but are central to achieving meaningful development outcomes. Indeed, it is sometimes in projects that say the least about women in particular where the questions can be most useful.

**ICTD and Environmental Sustainability** It has already been noted that the issue of sustainability is being given increasing importance in ICTD. This is driven by an increasing awareness that the pace of change suggested by ICT innovation has not necessarily led to rapid improvements in the relative positions of rich and poor peoples with respect to equity and life experience (McNamara 2003). When ICTs revolutionize non-digital practices, how can we ensure that those benefits are maximized not just in the immediate present, but for generations to come? This perspective prompts us to consider the physical environments where people live and work in the information economy. These concerns become particularly pressing in an era of global warming, an unintended consequence of previous technological innovations that have been central to economic development (The Presidents of National Science Academies 2005). The potential of ICTs to reduce resource consumption - through the reduction of paper use and travel expenses and through efficiency gains - is well-known. However, the negative environmental effects do seem to be distributed to less developed countries where appropriate regulatory controls
are not always in place to govern the disposal of obsolete computer products.

Grossman (2006) notes that the world generates somewhere between 20 and 50 million metric tons of "e-waste" every year, and that the elements that illuminate liquid crystal display (LCD) screens in portable technologies can cause damage to the brain and other vital organs. These issues are not necessarily present when we are considering the ICTD potential of mobile phones for example. But when we note that over one billion phones are expected to be sold in 2009, and that only 5 percent of them are ever recycled, the scale of the issue becomes clear (Huang and Truong 2008).

These waste products enter other parts of the human ecosystem in ways we do not expect. For example, Weidenhamer and Clement (2007) found that some jewellery manufactured in China was highly leaded (ranging from 0.07 percent to 99.1 percent lead content), consistent with the use of recycled solder from electronics production. Such jewellery has already caused consumer deaths and, undoubtedly, there are negative effects on those working in the manufacture of these items. It should be noted that China is unique only in the scale of its manufacturing, and it has taken many legislative steps to ensure the responsible use of e-waste (People's Republic of China - Ministry of Information 2006). However, it is clear that with e-waste being increasingly sent to developing countries in the region for disposal, the issue will require stronger enforcement of regulations and sensitivity to the downstream effects of electronic production. Ironically, although ICTs can reduce the use of resources such as paper, the largest gains in resource savings occur in already resource-rich regions, while unsafe byproducts are much more likely to be distributed in poorer regions.

INFRASTRUCTURE

So far, we have discussed the analytic lenses that are important in ICTD. At the level of infrastructure, connectivity has continued to dominate ICT discussion in the Asia Pacific region. Between 1999 and 2006, the number of Internet users in Asia and the Pacific increased five-fold, from two to 12 per 100 inhabitants. But this is still below the world average of 17 and far below the figures of 69 in North America and 43 in Europe (UN ESCAP 2007). Nevertheless, economies of scale and the increased number of Internet users pushed the demand in this sector from "no or limited connectivity" to broadband and a level of "bandwidth redundancy". However, in 2006, there were still only three broadband subscribers per 100 people in Asia and the Pacific, compared with 20 in North America and 16 in Europe (UN ESCAP 2007).

It is not only the throughput (usually measured in bits per second) of the Internet connection that is important. The latency of commonly used satellite-based bandwidth makes it unsuitable for many services such as Voice over Internet Protocol (VoIP). One solution for these countries has been to join consortia to install and use under-the-sea fibre optic cables. The first South East Asia-Middle East-Western Europe cable system (known as SEA-ME-WE) was introduced in 1985. Fibre optic cable was laid to establish SEA-ME-WE 2 connecting the three zones in 1994. SEA-ME-WE 3 introduced "Wave Division Multiplexing" (WDM) technology in 1999, connecting 39 landing points in 33
countries from Germany to Australia. In November 2005, SEA-ME-WE 4 would carry 1.2 terabytes per second (Tbps) of bandwidth. This cable system has connected 16 landing points in 14 countries in the three continents (Undersea Cable 2006). Most of the companies that formed this consortium are government- or state-owned enterprises.

However, the submarine cable system does not seem to be adequate for the demand and it is susceptible to disruption of services. Thus, governments have been looking to the private sector to develop alternative or additional submarine cable systems. For example, Bharti Airtel, a private company in India, is joining five other companies in Japan, Malaysia, Singapore, and the US to build a high-bandwidth, undersea fibre optic cable linking Asia and the US, to go live in 2010. The Bangladesh government has also decided to allow a second submarine cable financed by the private sector to maintain uninterrupted overseas voice and data communications and to back up its existing undersea cable.

Google is involved as a service provider and non-telecom investor in all three additional under-the-sea fibre optic networks that connect the US with the Asia Pacific region, marking a significant shift in funding models for data. The Trans-Pacific Express Cable System is going to connect the US with China, the Republic of Korea, and Taiwan. The Asia-America Gateway Cable System, which is being planned to come on service in the first quarter of 2009, will connect the US and several South Asian countries. The third cable is being planned by Reliance FLAG with a speed of $2 \times 1.28$ Tbps. When operational, these three cables will change not only the present landscape of bandwidth capacity, but also the price regime of connectivity in the Asia Pacific region, leading to further multimedia- and connectivity-based services in the region. The unknown economic question is whether the region is a net consumer or producer of such services.

In parallel to these external connectivity opportunities, there is a push by national governments to add capacity, and share or build up backbone infrastructure. In some landlocked countries such as Nepal and Cambodia, government-owned telecom entities are laying out fibre optic backbone connecting to the nearest country that has access to under-the-sea cable. Afghanistan is building its national fibre optic backbone following the national ring-road infrastructure and is planning to connect this with under-the-sea cable through Iran, Turkmenistan, Uzbekistan, Tajikistan, and Pakistan.

Some governments are making it a licencing obligation for service providers to rollout to rural areas. For example, in Pakistan, the private sector has led the expansion of three new nationwide optical fibre systems. One private telecom entity in Sri Lanka already owns a nationwide fibre network that is supplemented by Worldwide Interoperability for Microwave Access (WiMAX) technology for broadband to the door. The Indian government has directed the private incumbents to extend the network to rural areas (Samarajiva and Zainudeen 2008).

As the chapters on individual economies in this volume show, investment vehicles are being developed so that costs can be shared by various entities using the infrastructure. Australia has developed a hybrid plan where private companies would provide the infrastructure to the populous areas and government funding would make feasible the
rollout of services to most regional, remote, and rural communities. The Bangladesh government has recently signed a deal with the Power Grid Company of Bangladesh Limited to provide backup fibre optic network to the existing one.

Different governments in the region are also making substantial political commitments to broadband expansion, which is making investment in backbone infrastructure more viable in areas that were not commercially viable earlier (Samarajiva and Zainudeen 2008). For example, the Indian government is expecting 20 million broadband connections by 2010 and plans to ensure broadband connectivity in every school, health centre, and Gram Panchayat (local government units). Digital Subscriber Line (DSL) users in Pakistan now number 100,000, and the target is to reach 1.6 million in 2009. The National Telecommunications Commission of Thailand has already granted 12 licences for operators to conduct commercial trials of broadband wireless access and allocated frequency for this. The Malaysian government's Information, Communication, and Multimedia Services 886 Strategy (MyICMS 886) talks about eight new services to build up eight essential infrastructures that includes high-speed broadband. In the Republic of Korea, the IT839 strategy consists of the introduction of eight new services that it is hoped will prompt investment in the building of three essential networks. The synergies here are aimed at stimulating nine new sectors, including intelligent services and home networks. Notable is the link between enabling infrastructure and technology and the clear identification of the economic sectors to be stimulated, even if such outcomes are not always determined in advance (Shin 2007). Some of the roles governments can take in stimulating infrastructure are taken up further in the overview chapter on ICT policy.

At the logical layer of Internet infrastructure - between the hardware and end-user applications - changes are also occurring as many Asian countries are introducing next generation Internet protocol, Internet Protocol version 6 (IPv6), which allows greater flexibility in assigning addresses. IPv6 can support a bigger set of $3.4 \times 10^{38}$ (340 undecillion) unique addresses while Internet Protocol version 4 (IPv4), which is still widely used, was designed to provide about four billion unique Internet Protocol (IP) addresses only. China, Japan, the Republic of Korea, and Taiwan have been at the forefront of the first wave of IPv6 deployment, while the second wave has been led by Australia, India, Indonesia, the Philippines, Thailand, and others. One of the motivations for Asian countries to move to IPv6 was that Asian countries control only 9 percent of the allocated IPv4 addresses while they have half of the world's population. However, even though the protocol has been ratified for some time, IPv4 remains widely used and the challenges in stimulating widespread uptake point to the unusual governance questions that arise in an Internet environment with decentralized authority, as there are no incentives for managers of core infrastructure to deploy the new protocol.

**Mobile and Wireless** While fibre optic cable is still the dominant technology for back-haul within and between countries, the "last mile" of connectivity is increasingly wireless. The Republic of Korea launched the world's first Code Division Multiple Access (CDMA) 2000 1x3G network in October 2000 and Japan launched the world's first Wideband Code Division Multiple Access (W-CDMA) 3G (2 Mbps) network in October 2001. It is important to note that CDMA2000 and W-CDMA are types of third generation
(3G) cellular network that refer to mobile communications with roaming capability, broad bandwidth, or high-speed communication (upwards of 2 mbps) and represent a shift from voice-centric services to multimedia-centric ones. China, on the other hand, has developed its own 3G technology standard - Time Division-synchronous Code Division Multiple Access (TDSCDMA) - to reduce its dependency on western standards.

Although W-CDMA is the fastest growing technology in the richer economies of the Asia Pacific region (e.g. Hong Kong, Japan, the Republic of Korea), in other parts of Asia, such as in South Asia, CDMA2000 is experiencing substantial growth. India made an interesting example by not grouping 3G services with the older second-generation (2G) services and by offering its available radio frequencies not only for 3G services, but also for WiMAX services. A typical 3G or WiMAX mobile network can deliver very high-speed connectivity that can enable the network to run a variety of applications such as video telephony, video conferencing, mobile TV, interactive gaming, streaming video, music downloads, and mobile TV on a hand-held device.

In some other countries, like Indonesia, the government has taken the initiative to introduce local WiMAX service after the 3G service is rolled out by private operators. The government there is introducing 2.3 GHz local WiMAX using the Ministry of Post and Telecommunication network. But for many other countries, this WiMAX deployment is much more private sector-led. Taiwan, for example, has already issued licences to six operators to deploy WiMAX throughout the country by 2008. Global network performers such as Nortel and Intel have been deploying WiMAX service in South-East Asian countries. It is expected that by the end of 2009, Asia Pacific WiMAX subscribers will account for 45 percent of the total subscribers in the world. WiMAX services are rolling out very quickly in countries where 3G services are not yet available. For example, Tata has rolled out one of the largest WiMAX networks in the world at 3.3 MHz in 10 Indian cities, including Bangalore, Chennai, Delhi, Hyderabad, and Mumbai.

The 2007 UN ESCAP report suggests that at least three economies in the region (Macau SAR, Hong Kong SAR, and Singapore) have more than one mobile cellular telephone per person. The Maldives, along with China, India, and Macau SAR, registered the most notable increases in the absolute number of mobile phone subscribers in the last few years (see the relevant chapters in this volume).

**Technological Developments (Including Convergence)** The development of bandwidth infrastructure described earlier enables new forms of connectivity and also responds to demand coming from new applications (particularly audio-visual content delivery). Technological convergence continues as device manufacturers, software suppliers, traditional telecommunications companies, mobile operators, content companies, social networking companies, and providers of new wireless infrastructure jostle for position in determining the content and services that are delivered through ICTs. This leaves ICTD practitioners in a difficult position as ICTs are reliant on standards and multinational companies attempt to become "default standards", often leaving standards bodies and governments catching up in a reactive mode.
Vickram Krishna believes that "the recent development and commercial launches of ultra-compact low-energy consuming network-ready devices, such as the Asus EEE PC available at stunningly lower price points than previous “advances” in computing platforms, is seminal" (Vota 2007). The same is true for the One Laptop per Child (OLPC) XO and the Intel Classmate PC that are integrating features such as durable rugged design, flash memory (rather than hard drives), rechargeable power systems, built-in multimedia and wireless devices, and the like. These devices are competing with each other to get access to poor underserved classrooms of children, although there are substantial debates about total cost of ownership and the long-term suitability of these solutions for the least developed countries (Vota 2007). A case study in India, for example, shows that the introduction of computers in schools has resulted in the misallocation of resources and neglect of infrastructural facilities, which should be a higher priority (UNDP 2004).

At the other end of the scale, the rise of feature-rich, application-centric multimedia handsets led by Apple's iPhone model are rapidly changing the market. While many of these features are designed for more affluent users, they have the effect of setting the agenda for convergence and establishing models for associated service delivery that drive standards development. For example, the bundling of Google's video streaming application YouTube and mapping applications helps cement these sites as default platforms for such services. YouTube, for example, launched an Indian site with local content partners on 7 May 2008; many other territory-specific versions of the platform are being developed. As the iPhone begins an unprecedented rollout to over 46 carriers in 42 countries through 2008 (Elmer-DeWitt 2008), its importance, like that of the iPod before it, will be not only in terms of the volume of sales it makes, but also the way it shapes the market for telecommunications and integrated digital content. Asia Pacific is the world's largest market for smart mobile devices, accounting for 46 percent of worldwide shipments of 23.2 million in the first quarter of 2007 (Burns 2007).

Overall, the convergence of audio, video, and Internet content is rapidly reshaping the media experience in the region, and Internet networks and new ICT devices are central to the new content distribution platforms. Because national governments and content owners have little control over the development of standards used in integrated devices, there will be a number of challenging issues for content regulators and traditional content business models.

**EDUCATION AND HUMAN DEVELOPMENT**

This edition of the Digital Review has a number of chapters on ICT for education, and here we briefly touch on some of the larger trends. Given the awareness-raising and catalytic role of access to information for development, programs to eradicate illiteracy and support non-formal education through the increased use of ICTs such as radio, television, and the Internet are important. Furthermore, the development of the ICT sector in general depends on the preparedness and capacity of the critical mass who are the users, innovators, and developers of ICT applications in specific settings. Therefore, capacity and human development through ICT education remain a key policy focus for Asia Pacific countries.
In Brunei, for example, the Ministry of Education is involved in designing different programs related to ICT training and have introduced "e-learning systems" in all higher academic institutions that standardize Web technologies for creative learning environments. The Government of the Republic of Korea actually launched a separate program called the "IT Education and Training Plan for 10 Million People" in 2000 where they educated 13.8 million Koreans, including many employees of different government organizations. In 2004, they launched another program, called "Mid- to Long-Term Plan for Reducing the Digital Divide", where a key objective has been to develop computer literacy and capacity by offering different training programs. The Thai government has supported the availability of cheap computers (USD 230 per computer with a monitor) in the country and its introduction in different education institutes.

These examples indicate that many governments in the region are committed to the "development of ICT" by providing hardware, laying out infrastructure, and offering ICT training courses. This comes from a historical understanding of ICT as an independent field. But policies are being developed that respond to ICT as an enabling platform that crosses many fields. For example, the new Australian government's "education revolution" policy not only discusses ICT capacity development in all secondary schools, but also acknowledges that "computer technology is no longer just a key subject to learn, it is now the key to learning in almost every subject". The policy also aims to provide broadband or equivalent connection and one computer for each child in all secondary schools in Australia.

Almost all countries in the Asia Pacific region have advanced programs in computer education, particularly at university or higher education levels, and it is interesting to see that some countries do not necessarily have such programs at the lower levels. Take the example of the Maldives, Mongolia, Myanmar, and Nepal. Maldives College started to offer degree programs in Information Technology (IT) in 2005 and Villa College has been offering courses in computing and IT since 2007. In Myanmar, the University of Computer Studies in Yangon and the University of Computer Studies in Mandalay have started to offer degrees in computer science. On the other hand, countries such as India have emerged as pioneers in IT education and have been franchising their IT education businesses in different Asian countries using brand names such as Aptech and NIIT. One of India's most renowned IT institutes, the Indian Institute of Information Technology (IIIT), Bangalore, has started to make its science and engineering courses freely available on YouTube (youtube.com/nptelhrd.com) on a trial basis (Rebello 2008). The project is part of the National Project on Technology Enhanced Learning (NPTEL), a joint venture between the seven IITs and the Indian Institute of Science funded by the Ministry of Human Resource Development.

MEDIA AND CONTENT DEVELOPMENT

User motivation to access content and services is the key to the survival of infrastructure or the adoption of a technology platform. Whereas in the past it may have been adequate to build infrastructure or promote last-mile technology solutions, policymakers increasingly recognize that issues such as software localization and production of digital content are
critical to the development of sustainable demand for ICTs.

There are two prominent drivers of these processes. As more governments go online in line with their e-government policy, there is an increasing demand from the citizens to get content and related services in their local language. Users also have an increasing appetite for digital content and this has fuelled the growth of the three main online content markets: music, videos, and games.

In the 2003-2004 Digital Review of Asia Pacific, challenges in content development were identified in terms of tools, standards, human capacity, financial models, political culture, and legal frameworks. Although many of these challenges still exist, there have been many developments in the availability of some technical standards (such as Unicode) for many Asian languages and in the action plans of governments to include development or access to content as part of their policy framework. The PAN Localization Project, for example, has made considerable progress in developing the LINUX operating system in Nepali (Nepal) and in Dzongkha (Bhutan); optical character recognition and text-to-speech software in Sinhala (Sri Lanka), Bangla (Bangladesh) and Lao (Lao People's Democratic Republic); and a wide range of supporting applications and utilities, such as lexicons and fonts, in languages such as Khmer in Cambodia, Pashto in Afghanistan, Tamil in Sri Lanka, and Urdu in Pakistan. The project is also supporting more localization standards/tools that are being developed in Mongolian (Mongolia), Tibetan (China), and Urdu (Pakistan). In many countries such as the Republic of Korea and Vietnam, the localization process is led by different private companies that enjoy support from the government. The Vietnamese language has been standardized to Unicode UTF 8 by the Vietkey Group in Vietnam. Some other native languages of Vietnam, like Thai, Cham, Jarai, Bah"nar, Êê, M"nông, Sê ng, and K"hor are also in the process of Unicode standardization.

In many cases, government initiatives are important in spurring localization, particularly for minority language groups that may not yet constitute a sizeable market for ICT products. The Indian government has set up the Centre for Development of Advanced Computing (C-DAC) that has developed a localization framework for different Web applications, desktop-based applications, localized browser solutions, and the like. The Australian government has put policy emphasis on getting some endangered indigenous languages online as part of its digital content policy. The Afghan Computer Science Association has converted Microsoft Windows XP and Office 2003 into the Pashto language. And the Cambodian National Committee for the Standardization of Khmer Script in Computers (NCSKSC) has been instrumental in sensitizing the need for localization, introducing Khmer scripts in different government offices and offering ICT training programs in the Khmer language.

In Sri Lanka, all government websites are required to be multilingual (in Sinhala, Tamil, and English) and to use Unicode fonts. The Bangladesh government is working to enact the Right to Information Act that would enable more government information to be easily available on demand. India passed a Right to Information Act in May 2005. In Pakistan, an ordinance was promulgated in June 2002 ensuring people's access to information. All these would mean that content services from the government side would be a focal point of
citizen's demand in the coming years.

Localization is often pioneered by local volunteers and self-help groups in distributed networks, often without a formal organizational structure. The Bangladesh Open Source Network is an informal network that has not only developed a Bengali interface or version of different applications (such as Ubuntu Linux, Mozilla Firefox) in the local language, but also promoted localization through training camps in different institutions and by facilitating Bengali content development at Wikipedia. As of January 2008, Bengali Wikipedia has over 16,000 entries, one of the highest in the non-English language versions of Wikipedia. Sinhala Unicode Communities is a volunteer network in Sri Lanka that has been involved in promoting the use of Unicode in Sinhala and was supported by several freelance bloggers who organized themselves into community journalism forums to promote local content.

As the cost of access is reduced, we see an increased number of users producing and distributing content through blogs or short/multimedia message service (SMS/MMS) to connect and empower people through campaigns and action. In countries where the press enjoys little freedom, posting and reading content anonymously on the Internet have become an important source of media coverage. In Iran the number of Persian blogs run by Iranians is estimated to be around 800,000 this year, a 30 percent increase since the last year. In China, the population of bloggers is growing rapidly.

Digital content makes for a booming music, video, games, and animation industry. A recent report of In-Stat's Consumer Media and Content Service found that by 2011 in the Asia Pacific region online music revenues will reach USD 1.4 billion, video revenues will reach USD 2.7 billion, and the game industry will exceed USD 9.5 billion (Potter 2007). The question is how much of this revenue will remain in the economies in question and how much will travel to rights-holders outside the locality of sale. The importance of viable locally-owned content markets is reflected in the increasing emphasis on the creative industries in economic development strategies.

CONCLUSION

The pace of change in ICT continues to be intimidating for those seeking to make new innovations available for all. It seems that as soon as new bandwidth becomes available, new audiovisual services, which require ever more data, become the norm. The challenges for policymakers and for development practitioners are similar: how to make sense of it all and determine the best way to prepare stakeholders to benefit from these applications? When infrastructural issues develop so quickly, it is not simply a case of rolling out 2G, 2.5G, 3G, 4G, on the pathway toward development. Instead, the decision to implement the conditions for certain technologies always has an eye to the past (embedded capability and capacity to use new technologies) and the future (ability to build on the experience with learning that will be sustainable).

The Asia Pacific region is uniquely positioned with respect to ICTD. It is home to the largest manufacturing capability for ICTs, yet it is also home to over half the 1.6 billion
people in the world who live without electricity (UNDP 2007). The region includes nations such as China that are undergoing rapid economic growth, and highly developed nations whose economies are adapting rapidly to the high-technology manufacturing capabilities emerging in other areas. It also includes nations facing severe development challenges and structural poverty that will not be easily solved. The region has been in the media spotlight due to recent natural disasters, as well as the technologies that are being deployed to mitigate their effects. And the Asia Pacific region contains most of the world's languages and a growing infrastructure for cultural exports - a fact that ought to have some relevance for the focus on cultural development and creative industries such as digital content.

While it is difficult to generalize about the position of the Asia Pacific with respect to ICTD, the chapters in this edition of the Digital Review show that the different parts of the region have much to learn from each other, even as the region as a whole must respond to critical decisions that might be made in North America or Europe regarding device standards. In the technology sector, we are used to valuing the cutting-edge and innovative. But in the realm of development the promises of ICTs must be tested against their effects on human development in our specific locations in the Asia Pacific region. As ICTs continue to change the structure of economies and the processes of globalization, governments and communities will need to respond in ways that take into account the important and complex issues that go to the very heart of development.

NOTES
1 See DOI report at www.opt-init.org/framework/pages/contents.html
2 The 16 companies that form the consortium include Algeria Telecom (AT), Bharti Tele Ventures (India), Bangladesh Telecom (BTTB), Telecom Thailand (CAT), France Telecom, MCI, Pakistan Telecom (PTCL), Singapore Telecom (SingTel), Sri Lankan Telecom (SLT), Saudi Telecom (STC), Telecom Egypt, Telecom Italia Sparkle, Telecom Malaysia, Tunisia Telecom, VSNL (India), and Etisalat (UAE).

Source: http://www.digital-review.org/themes/ Accessed on 02/03/2010