Chapter 1
Why National e-Transformation Strategies?

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We are at a turning point in history, shaped by globalization, and the information and communication technology (ICT) revolution.[1] This technological revolution has sparked and enabled a late twentieth and early twenty-first century wave of globalization—a deeper global integration that goes beyond the trade liberalization that enabled the first wave of globalization. ICT is enabling the creation and management of global networks, as ICT is used to coordinate production and services, expedite and monitor delivery, share ideas and information, and collaborate on design and research. As a general purpose technology (GPT), ICT has been transforming logistics, enabling global demand-driven supply chain management, transforming services and manufacturing, enabling the offshoring of production and outsourcing to suppliers in emerging markets, and diffusing innovations across all kinds of economic and social activities (Hanna 2009a, b). In turn, globalization is enabling the diffusion of ICT and associated innovations, at a faster pace than any GPT in history.

The ICT revolution is the preeminent technological revolution of our time. It is perhaps more profound than any other in history in terms of its speed and pervasiveness (Hanna 1991, 2009a, b). The impact of the ongoing revolution extends beyond the developed countries to countries at all levels of development. It extends from industry to services and from business to public agencies, communities, and civil society organizations.

[1] ICT is broadly defined to include electronics, semiconductors, and microprocessors, as well as broadcasting, computers and communication technologies.

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The ICT revolution continues unabated—driven by Moore's law,[2] network effects (Metcalfe law),[3] and the continuing dramatic advances in communications (Internet, broadband, mobile, wireless, social networking) technologies, and in sensing technologies (GPS,[4] RFID,[5] Internet of Things). This revolution is by no means a spent force, as diffusion advances and deepens, and for the majority of developing countries, it is just beginning.

The ICT revolution lent impetus to development miracles in East Asia (Yusuf 2003; Hanna et al. 1996). These countries were early adopters of ICT, and by harnessing this GPT, they were able to transform industries, modernize their logistics, insert themselves into global supply chains, enlarge the gains from trade, and maximize the returns from globalization. Singapore is a model of this ICT-enabled development paradigm. Other emerging markets are following their models, with many variations. Some, like India and Ireland, are specializing in software, Business Process Outsourcing (BPO), and IT Enabled Services (ITES). Others, like Finland, have leveraged the ICT revolution for diversifying the economy beyond forestry, and for building an innovation-driven economy.

Looking to the future, this transformation will be also increasingly shaped by the limits to energy-intensive growth. Environmental pressures, rising energy prices, and resource scarcity are posing limits to energy- and material-intensive growth. Climate change calls for reinventing the transportation system, revamping the energy system, reindustrializing the planet, and dramatically shifting toward greener products and lifestyles. The race is on to build a new clean energy economy that can sustain human civilization.

An emerging role of ICT is in globalizing research and development activities, and enabling the rapid and wide creation and dissemination of ideas and innovations. Countries are learning to harness ICT to transform their education systems, deepen their learning capabilities, and improve interactions among participants in their national innovation systems. Globalization forces, enabled by ICT, are opening up national systems of learning and innovation, and mobilizing talents and ideas

[2] According to Moore's Law, the number of transistors on a chip roughly doubles every 2 years. The cumulative impact of these spiraling increases in capability power the economy and the Internet, running everything from digital phones and PCs to stock markets and spacecraft, and enable today's information-rich, converged digital world.

[3] A network effect (also called network externality or demand-side economies of scale) is the effect that one user of a product has on the value of that product to other people. When network effect is present, the value of a product or service increases as more people use it. According to Metcalfe, the value of the network is proportional to the square of the number of users.

[4] The Global Positioning System (GPS) is a space-based global navigation satellite system that provides reliable location and time information anywhere on earth and is freely accessible by anyone with a GPS receiver (Wikipedia).

[5] Radio-frequency identification (RFID) technology uses communication via radio waves to exchange data between a reader and an electronic tag attached to an object, for the purpose of identification and tracking.

across the world. Electronically mediated interactions are giving birth to virtual communities, transcending geography, institutions, and disciplines.

Ubiquitous connectivity and new platforms for collaboration and information sharing are enabling new models of open innovation and mass collaboration—mobilizing and leveraging the collective knowledge and creativity of citizens and businesses around the world (Tapscott and Williams 2010). Open innovation and mass collaboration can tap into the global diffusion of information, knowledge, and innovative capabilities. And an increasingly complex set of global challenges, such as environmentally sustainable growth and poverty reduction, calls for open and collaborative models of innovation.

The Internet is destroying old models of media and enabling new forms of communications, and these new forms are leading to global and instantaneous diffusion of information. Information diffusion is leading to power diffusion and challenges to old forms of organization and governance. NGOs and individuals, empowered with information and communication, have become key local and global actors—powerfully influencing governments and markets, and building new models of collective action and bottom-up development.

As the ICT revolution opens up new sources of growth, it also poses new risks and challenges. It threatens the competitive advantages of countries as it transforms industries and services in dramatic ways. It poses major uncertainties. For some industries and countries, it raises the bar for competing in the global marketplace, and for others, it lowers entry barriers and multiplies the number of players. It accelerates product and process change, demands experimentation and innovation, and calls for openness, flexibility, adaptation, and fast learning. It challenges countries to invest in their knowledge and communication infrastructures.

The ICT revolution offers avenues to leapfrog traditional stages of industrialization, and these routes have been taken by inspiring examples like Korea, Finland, and Singapore, and even larger countries like India and China. The ICT revolution is not the arena of the few or some privileged sectors. It is not limited to ICT as a sector, or to high-tech and knowledge-based sectors—it extends to all types of industries and services. Considerable gains in Total Factor Productivity (TFP) now come from institutional and business process innovations, enabled by ICT. The ongoing revolution also opens new opportunities to solve long-standing development problems through effective delivery of health and education services, new learning and training systems, and effective agricultural extension systems.

Chapter Organization

We first discuss why ICT is a game changer for global growth, welfare, development, and sustainability. The literature covering both the current and potential pervasive impact of ICT locally and globally is voluminous and increasing (see for example, Friedman 2005; Tapscott and Williams 2010; Hanna 2009a, b, 2010).

First, we focus on how globalization and ICT have been mutually reinforcing and have opened up opportunities for developing countries to accelerate their development.

Second, we illustrate how ICT can help meet three global challenges: (1) achieving energy and environmental sustainability; (2) building platforms for open and collaborative innovation; and (3) promoting participatory development and governance.

Third, we articulate the concept of a techno-economic paradigm shift and the substantial investments in policy and institutional adjustments, learning, and human capabilities that are required to make such a shift.

Fourth, we describe the responses of the majority of countries and aid agencies to the challenge of the ongoing ICT revolution and the imperatives of its techno-economic paradigm. Their basic responses and their limitations are defined: (1) as the ICT revolution is primarily driven by business, leave this transformation process to market forces; (2) as ICT is a new and pervasive technology and options abound, we should focus on pilots, micro-interventions, and quick wins with no need for overarching national strategy; (3) given complexity, focus on one element of e-transformation at a time; and (4) given the speed and uncertainties of technological change, focus on short-term adaptation and serendipity. We argue that these responses are inadequate and explain why a national e-transformation strategy is needed.[6]

Fifth, we define e-transformation as such a paradigm shift, induced by or required to harness the ICT revolution. We argue for moving from the "why" to the "how" of e-transformation and indicate that this book is concerned with the latter—meeting the specific challenges governments face in designing and implementing economic and social transformation through ICT. Case studies are to be used to show the "how" and what can be learned from successes and failures.

Sixth, we propose an integrated framework for understanding the holistic nature of e-transformation and for designing strategies to take account of key interdependencies among its elements. The aims of this framework are outlined. Country experiences can be analyzed and assessed, and gaps and weaknesses can also be identified using the e-transformation framework. Thus, all country case studies of this book examine national ICT strategies through the lens of this framework.

Finally, this chapter concludes with an overview and organization of the book.

Globalization and ICT

The globalization of the last 2 or 3 decades gathered momentum from trade and financial liberalization, and the diffusion of innovations sparked by the powerful new GPT, ICT. A steady decline in the costs of surface transportation reinforced

[6] In the final chapter, we conclude with a critique of the current roles and practices of aid agencies, in light of the lessons learned about successes and failures of the country case studies covered in this book and its companion (Hanna and Knight 2011).

the effects of lower tariff barriers; this reduction in costs arose from technological advances such as containerization, port modernization, and advanced logistics and trade facilitation—all aided by ICT applications. The growth of trade was boosted by the offshoring of manufacturing from the US, Japan, and the European countries to industrializing economies, and an international production system began to take shape initially led by multinational corporations (MNCs)—again enabled by ICT. The initial round of production offshoring and outsourcing to suppliers in emerging economies was followed by a far-reaching elaboration, specialization, and geographical dispersion of production made possible by growing networks and expertise in managing complex manufacturing and product integration processes. ICT played a key role in enabling the dispersal of manufacturing through the standardization and modularization of products and intermediates, and the codification of production techniques (Yusuf and Nabeshima 2011).

ICT lent impetus to the industrial miracles in East Asia. It is by harnessing the potential of ICT that countries were able to maximize the returns from other elements of globalization. Countries that proved adept at exploiting the Internet and digital technologies, and became efficient producers of manufactures, enlarged the gains from trade, attracted more capital, and entered into advantageous virtuous spirals (Yusuf and Nabeshima 2011).

Combined with liberalization, ICT played a similar role in enabling the globalization of financial services, and increasingly, other services. ICT made possible the outsourcing and offshoring of impersonal services thereby enabling countries such as India and the Philippines to build entirely new and thriving services sectors specializing in BPO, ITES, and software within a decade or two. The Internet has become a major force driving change by mobilizing and networking talents across the world.

Another facet of globalization is the role of ideas, their production, and rapid as well as widespread dissemination via the many channels created by ICT-enabled networking. The revolution caused by advances in ICT is widely associated with new products and in the ways products are manufactured. Product innovation was powerfully reinforced by the numerous collaborative innovations in other areas: services, institutions, organizations, management systems, etc. ICT has proven to be an extraordinarily potent transformative force in all these aspects of innovation and in creating cross-disciplinary and global learning communities.

Globalization and ICT have become drivers or enablers for disseminating ideas and technologies, with countries that built modern learning and innovation systems capitalizing on the new opportunities much faster than the laggards. Leveraging globalization and ICT, successful countries linked their national systems and mobilized talent from throughout the world. The continuous deepening of knowledge in every field is demanding even greater specialization and the pooling of expertise drawn from several subdisciplines. National systems of learning and innovation nurture these specializations but it is ICT and globalization that have spurred networking and collaboration by encouraging electronic interaction among specialists, by giving birth to virtual cross-disciplinary communities of researchers, by making innovation a global enterprise, and by creating channels permitting the exchange and circulation of ideas or research results.

Globalization was an enabling element for the success of countries like Singapore and Finland. Other countries were equally well positioned to move forward, but did not. We contend that these successful countries, among others, moved quickly to harness the powerful forces unleashed by ICT to take maximum advantage of globalization.

These various facets of globalization reflect the diverse and expanding roles of ICT: first to automate information and data processes, initially within firms and then extending to global supply chains; second, to migrate information acquisition, search, and transaction activities to the Internet, as stores of information were connected to the network; and third, to access valuable human resources and innovation capabilities and mobilize them in supply chains that interconnect the global economy (Spence 2011a).

Before the diffusion of the Internet, a large fraction of human resources were devoted to storing and processing information. A first wave of automation involved productivity-enhancing, labor-saving forms of technological progress. This process continues in both advanced and developing economies, with the introduction of ICT-enabled flexible manufacturing and advanced manufacturing processes.

With the Internet, ICT impact was extended to the information layer that coordinates and controls the underlying economic processes across all sectors of the economy. This role of ICT brought about dramatic reduction in transaction, coordination, and control costs—creating new forms of agile global firms, new enterprises with global reach, and new blends of organizations and markets. With increasing instrumentation and intelligence embedded into the Internet and various processes, new breeds of smart transportation, smart energy, and smart urban systems are likely to emerge.

This impact was extended to information- and knowledge-intensive services. The Internet became a platform for the delivery of a long and expanding list of services: e-finance, e-business, e-government, e-learning, e-publishing, and so on. What drives all of this? It is the dramatic reduction in the cost of finding, communicating, and transacting—in transaction costs. Before the Internet, the costs of delivering many of these services were either prohibitive, or, in developing countries, such services never reached the majority of the population. The practical effect of the Internet is to increase knowledge, access to information, the power of informed consumers and citizens, and the transparency and effectiveness of decision-making. As Spence admits, "it is hard to know how to quantify these effects…but that does not diminish their importance" (Spence 2011a, p. 232).

The most recent and significant long-run effect of ICT's spread is to access and mobilize human talent locally and globally. The defining features of the Internet are speed, multimedia connectivity, irrelevance of location, interactivity, and asynchronous communication. These features are enabling both insourcing and outsourcing a growing array of services: software development, business processes, customer services and support, medical diagnosis, learning activities, and so on. The volume of such activities has been growing between 30 and 40% annually. This trend opens up major opportunities for finding and utilizing highly skilled human resources all

over the world. This is not only beneficial for large recruiting countries like the USA, but also small countries like Singapore, and of course, many developing countries with large pools of human resources.

But what about the distribution of benefits of ICT revolution and ICT-enabled globalization? Will this revolution herald the onset of global economic inclusion or increasing tensions and divides? This is an area of great concern to many developing countries and even among developed countries. Globalization and its enabling ICT revolution have been sold initially as benefitting everyone, and then modified to "potentially benefitting everyone." Some leading economists (e.g., Spence 2011a, b) have now argued that the primary beneficiaries will be the developing economies as these forces are speeding up economic growth in large developing economies and causing "the next convergence." The best defense of globalization and ICT diffusion is that hundreds of millions of people in developing countries are better off. Encouraging trends for developing countries include, among others, the outsourcing of services to developing countries like India and the Philippines, the increasing participation of advanced developing countries in the global supply chains and production networks, the dramatic diffusion of mobile phones in developing countries, the potential of dramatic decrease in the transaction costs for remittances to developing countries (using mobile phone-based electronic banking), and the aggregate effect of reducing the transaction costs of many other essential services.

On the other hand, we know much less about the distributional effects of globalization and the digital revolution and how to deal with these effects within and across countries, at least over the short to medium term. The great recession that started in 2008 has increased the concern that the distributional impacts will be greater and more adverse in advanced countries. Dealing with distributional effects has proven to be hard within advanced economies (Spence 2011b). For the majority to benefit, it is assumed that losers would be compensated through redistribution of income, and that seems to be increasingly harder to do (politically) in advanced countries under slow growth conditions, except for a few small countries like Singapore and Finland. But dealing with these distributional effects is likely to be even harder in developing countries, where inequalities are much higher, and have been increasing even among the fastest growing economies. While it is a promising development in support of inclusion, the diffusion of mobile phones does not eliminate the digital divide, nor other more fundamental divides like basic education.[7] The case studies of the Philippines and South Africa show promising initiatives for inclusion, but also show how difficult it is to address this challenge.

[7] Recent and projected advances in smartphones are very promising, as these devices are becoming available at increasingly low price points and consequently to a wider consumer audience, particularly in emerging markets. Smartphones will increasingly become mass-market devices for Internet connectivity and diverse applications, driven by fierce competition, technological advance, and phenomenal increase in applications using open source tools (Pyramid Research, June 2011).

Meeting Three Challenges

In this section, we illustrate how ICT can help address three global challenges: (1) energy and environmental sustainability; (2) collaborative and accelerated innovation; and (3) participatory development and governance. The aim is to give more concrete examples of the opportunities that ICT has been opening to solve global and local development challenges.

ICT for Energy and Environmental Sustainability

Climate change is emerging as the biggest issue with which human civilization has ever had to cope. With the increasing concern about global warming and polluting industries, the pressures are on to integrate information technology solutions to manufacturing processes, optimize the use of raw materials, monitor processes and reduce their energy consumption, and optimize logistics and distribution. Fortunately, ICT promises a new growth paradigm that is less material-based and energy-intensive—a smart, green growth strategy. ICT is enabling profound transformations in the way we work and live, toward more sustainable lifestyles for an energy-challenged planet.

ICT is expected to continue to drive energy-efficiency improvements. Several studies indicate that the potential for improvements are substantial. For example, A McKinsey report estimates that cost-effective investments in existing energy productivity technologies (ranging from more efficient lightening, to more efficient home appliances, to advanced power plant technologies) could improve energy production and use in the US by 25% over the next 20 years (Bressand et al. 2007). ICT would clearly contribute significantly to all these improvements. Another study of the US estimated that ICT can reduce the growth of carbon emissions by one-third over a decade, as a result of continued ICT diffusion in e-commerce, supply chain management, telecommuting, reduced paper and materials consumption, shift in growth to less energy-intensive sectors, and ICT-driven efficiency improvements in a wide range of equipment (Laitner and Ehrhard-Martinez 2008).

A study by McKinsey's Global Institute concluded that the world could cut projected global energy demand growth between 2008 and 2020 by at least half by capturing opportunities to increase energy productivity. A similar study in Japan projected that widespread use of ICT could reduce carbon emissions by over 40% by 2050. The reductions would come from intelligent transportation systems, widespread teleworking, and ubiquitous home energy management systems (Laitner and Ehrhard-Martinez 2008).

ICT is also enabling the digitization of media and business processes, and the "dematerialization" of the economy. Digital movies and music, Web-based news, and electronic banking, all digitally distributed or transacted over the Internet, are among the many examples of relying less on paper, hardware, and other energy-intensive vehicles. Similarly, ICT can drive energy-efficient practices in business. With lean manufacturing and digitized processes, energy can be saved at every step

of the production and supply chain. ICT is also allowing more effective utilization of transport systems—using ICT to better schedule flights and raise seat utilization in air transport, for example. Some ICT applications could facilitate carpooling and ridesharing, and ease congestion and select optimal routes. New e-commerce-enabled business practices like Amazon.com's centralized warehousing are less energy consuming than brick-and-mortar retail operations.

Applied to energy management, ICT is used to achieve more efficient and reliable control of electric grids—transmission and distribution of electric energy. Sensors in transformers and substations allow rapid detection of outages and other malfunctions and prompt dispatch for repairs. Smart meters installed in the premises of final users permit two-way communication that can be used to implement smart marginal-cost pricing policies. This includes the ability to turn off or reduce consumption of appliances in consumer premises—using plug-in hybrid vehicles and intelligent home appliances. Smart grids also help monitor and control energy theft, very significant in many developing countries.

Two-way communication in the grid can also favor cogeneration from renewable sources owned by consumers (solar, wind, small hydro). Accordingly, the pro-sumer gets credit for contributions to the grid. Another use is for plug-in-electric vehicles, whose batteries can also be used as a source to store energy generated or acquired at nonpeak periods and resell it to the grid at peak periods if plugged in. Under appropriate regulation, this allows sale of broadband Internet connections as well as power to consumers.

Energy and environmental management also depends on strategic planning, monitoring, knowledge networks and adaptation strategies, real-time energy demand management, and monitoring and acting on the environment. e-Enabled green policy networks as well as e-enabled carbon markets are emerging to help formulate energy and environmental policies and adaptation strategies. Adaptation strategies are further supported by ICT-enabled knowledge building and connecting to those on the frontline.

In sum, ICT has catalyzed important innovations in energy efficiency. It is also revolutionizing electricity production, distribution, and consumption. Moreover, new energy production technologies, including solar and wind power, rely heavily on ICT for their design and management. The trend toward ICT-driven improvements in energy efficiency is expected to continue as the most promising ICT-enabled innovations are still in early stages of implementation even among advanced countries.

But market forces alone cannot provide the pace and scope of innovations required to meet the urgent national and global need for green energy supply and use, and to overcome the huge built-in incentives for legacy energy technologies and energy-intensive consumption practices (Weiss and Bonvillian 2009). The impact of ICT on energy and the environment can be significant, but will depend on how quickly and fully society will adopt not only available ICT capabilities, but also policies to spur adoption of ICT-enabled energy-conserving practices. ICT-enabled transformation toward a green growth paradigm will require massive investment in policies, institutions, and smart infrastructure, involving extensive collaboration between government, business, civil society, and universities.

Collaborative and Accelerated Innovation

An ICT-enabled new model of innovation, involving open source and mass collaboration, is sweeping across all sectors in the advanced economies. It allows people with drive and expertise to take advantage of new Web-based tools to reshape established institutions and the world (Tapscott and Williams 2010). A new era of collaboration in business is emerging, and many promising examples show how business, government, civil society, and individuals can leverage collaborative technologies to work in new ways to solve the greatest problems of our time. Collaborative innovation promises to revolutionize work, as well as how we live, learn, create, and govern.

A new environment fostered by the Internet and the rise of networked intelligence together suggest that organizations can succeed by embracing collaboration, openness, sharing, and interdependence. There is a growing realization that the collective knowledge, capability, and resources embodied within broad horizontal networks of participants can accomplish more than one organization or individual acting alone. Twitter, Facebook, and Wikipedia have captured the popular imagination about collaborative innovation and content creation, but there are many other examples of companies and communities that apply collaborative innovation, with great impact (Tapscott and Williams 2010). A few examples of platforms that radically cut collaboration costs and make accessing the global marketplace for ideas, innovations, and talents are Linux, InnoCentive, NineSigma, iPhone, Open source, Proctor and Gamble's open innovation called "Connect and Develop," and General Electric's "virtual collaboratory"—all developing Internet-based global platforms for collaboration and innovation.

Open and collaborative innovation tools are promoting collaborative education. Collaborative tools can transform pedagogy through collaborative learning, interactive computer-based courseware, just-in-time teaching, course content exchange (like MIT's OpenCourseWare), course content co-innovation, and even customized student-centered collective *Syllabi of the World* (Tapscott and Williams 2010). Foundations are organizing large-scale innovation contests as a way to generate ideas and turn them into radical breakthroughs that will benefit humanity. The World Bank has recently organized a global contest on "Apps for Development."

Internet-based platforms for innovation and mass collaboration can be applied to the challenges of saving the planet. The Internet and interactive ICT tools open up new ways to marshal and exploit the collective ingenuity of citizens and businesses, provide transparency around climate change, build pressures for policy and political solutions, and stimulate widespread consumer and business action. Opening up university and government databases and supporting transparency brokers can make climate change information accessible to the public and key institutions, and this information can change perceptions, improve understanding of causes and consequences, and compel participants to search for solutions or accept the need for new regulations. A site called Carbonrally pits teams from around the world against one another in contest to see who can reduce their carbon footprint the most (Tapscott and Williams 2010). EarthLab.com translates science into digestible pieces of

information that can actually influence people's behavior and gives consumers reliable estimates of their personal carbon footprint.

Many companies are working in isolation to invent, scale, and disseminate new sustainable technologies, and in the process are developing portfolios of sustainable technologies, many of which are not core to their business model. Nike's Sustainable Business and Innovation Lab is one example—developing recyclable materials for producing their products. Technologies like these will only get better and cheaper for Nike the more other companies use them and achieve economies of scale. A collaborative approach to R&D, by like-minded companies, could create common pools of industry knowledge and processes upon which new sustainable industries are built. GreenXchange, a database and a new model of patent licensing, makes it easy for companies to share sustainable technologies, and for all to know what intellectual property is available and who is using it, while recognizing the intellectual leadership behind the technologies being shared (Tapscott and Williams 2010).

Emerging applications of collaborative innovation in the public sector are no less inspiring: the "Apps for Democracy" contest by the US federal government, open sourcing government (Web-enabled collaboration with citizens, civil society, and the private sector for public services), participatory budgeting, Data.gov (an open hub for government data) to help cocreate information-based services, and the use of social networks to reinvent government from the bottom-up. The US Government is investing in the building blocks and practices of open innovation, by connecting databases and opening them up to the public for innovative uses by businesses and individual citizens. It has also established an innovation fund for government agencies to give out small "challenge grants" to groups or individuals to solve some of the biggest problems facing these agencies. Thus governments are becoming platforms for creating public value through information sharing and co-innovation with private sector and civil society.

While celebrating the power of collaborative technologies—mainly applied in advanced countries—vested interests maintaining closed systems and authoritarian governments present formidable barriers to widespread use of these technologies.[8] We should not underestimate the barriers of adopting, spreading, and scaling up collaborative innovation in the context of the digital divide and institutional rigidities that prevail in developing countries. National e-transformation policy and strategy must address these barriers and the role of new leaders, public policies, and national strategies in making open and collaborative innovation a mass movement that can reboot development and address global poverty.

Participatory Development and Governance

Much of failed development is the outcome of top-down strategies and *dirigiste* plans, and the lack of collaboration among government, business, and civil society

[8]Recent pro-democracy movements in the Arab World among others, are empowered by social networks and mobile communications.

in shaping these strategies. These strategies have been framed in an environment of information scarcity and based on a common conception of passive recipients of development programs. The alternative route has been to leave development directions to market forces—leading to growing inequalities and unaddressed market failures. Recognizing the limits of the state and the market, new development thinking is turning to building partnerships among stakeholders, and catalyzing and leveraging community knowledge, creativity, and capital to promote grassroots development.

Development is increasingly viewed as a local process of change and learning (Rodrik 2004; Rodrik 2007; Stiglitz 1999a, b, 1998). Sustainable development is as much about social and institutional transformation, as it is about economic transformation. It depends on local participation, empowerment of community organizations and change agents, and mobilization of local knowledge and resources. It requires societal ownership, partnerships among stakeholders, and enhanced experimentation, accountability, and evaluation of results (Hanna and Picciotto 2002). Institutional innovation, entrepreneurship, technological change, and capability development are at the heart of this process (Rodrik 2004, 2007; Dosi et al. 1988; Freeman and Soete 1997).

Top-down strategies have tended to rely on "push" programs, based on forecasting needs and then designing the most efficient investment programs to ensure that the right people and resources are available at the right time and place using scripted processes and standardized applications. Such push programs have their place in driving e-development, and they have dominated development planning and policymaking. They remain amenable to elite control and central institutions. But fundamental shifts are changing our world and making it possible to use pull strategies (Hagel et al. 2010). The digital infrastructure is advancing and spreading rapidly and in turn intensifying competition; enabling outsourcing; lowering barriers to entry; and enabling the flow of capital, talent, and knowledge within and across organizations, and across countries. In turn, these fundamental changes allow for new institutional innovations and new "pull" techniques and practices: open innovation, pull or collaborative platforms, cross-sector and cross-institutional partnerships, and leveraging change agents.

The ICT revolution is making it possible to build a more widely distributed information environment and knowledge-enabled collaborative world. Informed citizens are better equipped to take advantage of opportunities, access services, exercise their rights, negotiate effectively, and hold state and non-state actors accountable. In this environment, inclusive and pro-poor growth strategies can harness the collective knowledge of society and the resourcefulness of communities.

The new ICT tools have the potential to mobilize and strengthen the demand for good governance—liberating government information, building awareness and demystifying information on policies and rights, encouraging consultations, promoting collective action, monitoring performance, institutionalizing avenues for citizen feedback and grievance redress, etc. The mobile phone, Internet, Web 2.0 (participatory Internet, with user-generated content), social media, and the growing array of information and communication tools empower citizens to access unfiltered

information, register their demands, and shape public services to meet these demands. These tools create contexts or platforms that allow people to self-organize and to create things that are valuable for themselves, and maybe for the world. Widely diffused mobile communication devices and ubiquitous networks empower citizens to hold the state accountable through participatory budgeting and monitoring, monitoring public expenditures on schools, monitoring local implementation of various development programs, disseminating information on laws and regulations and who is responsible for what in government, etc. They also make the co-innovation of development programs and public services much more possible (Hanna 2011).

The applications to which mobiles are being put by the users, frequently the poor, show extraordinary creativity (Hanna 2010). Examples abound. Safaricom, a Kenyan-based mobile operator, has developed nationwide a mobile banking (m-banking) service called M-PESA (mobile phone-based money transfer), that allows Kenyans to transfer money via SMS. The service does not require users to have bank accounts, an important aspect in a country like Kenya, where many people do not have bank accounts. M-PESA is being also used to receive remittances, so the user can buy digital funds at any M-PESA agent and send that electronic cash to any other mobile phone user in Kenya, who can then redeem it for conventional cash at any agent. It has contributed to a significant growth of remittances within Kenya. An M-PESA-enabled mobile phone can also be used to pay for many services—from school fees to utility bills, to many other basic services. It has spread widely in Kenya, with subscribers far exceeding those with Bank accounts. Safaricom has partnered with over 100 organizations that accept payments using M-PESA, ranging from banks, government agencies, and media houses, to microfinance institutions and insurance companies. M-PESA is being rolled out throughout Africa, the Middle East, and beyond.

Ushahidi, also a Kenyan-born organization, developed a crowd-sourcing information and Internet-based mapping site that allows users to submit eyewitness accounts of election fraud and riots via e-mail, text, or Twitter, then was later used during Haiti earthquake and other crises to allow users to submit their accounts and other relevant information in a disaster situation—and then visualize the frequency and distribution of these events on a map. It helped a global effort to crowd-source assistance for Haiti. It is one of many examples of tools that empower millions of ordinary individuals to play a larger role in development, from democratic decision-making to crisis management, to protecting public health (Tapscott and Williams 2010).

New communications technologies, combined with old, particularly mobile and social media, combined with satellite broadcasting, can help empower citizens and expand freedom, political and economic. Social media—text messaging, e-mail, photo sharing, social networking, etc.—have become coordinating tools for nearly all of the world's political movements. As the communications landscape gets denser and more participatory, the networked population is gaining greater access to information, more opportunities to engage in public conversation and speech, and a vastly enhanced ability to organize and undertake public action. Examples during the first decade of twenty-first century are many—the Philippines, Moldova, Iran, Chile, South Korea, etc.—with no preordained outcomes (Shirky 2011).

Demonstrations starting in early 2011 in Tunisia and Egypt, and spreading elsewhere in the Middle East, show the increasing role of new media and social networks in raising shared awareness, and enabling grassroots coordination in support of political freedom and economic justice.

The new ICT tools and platforms are enabling or facilitating a power shift in the way citizens engage with the state. The growing number and networking power of community service organizations (CSOs), demographic changes (youth and urban population growth), ongoing decentralization reforms, and open government initiatives and laws are all contributing factors to this power shift. ICT complements and reinforces those contributors to the power shift. These factors are strengthening the demand for good governance and the capability of citizens to hold the state accountable. The spread of ICT, including mobile, social media, and satellite broadcasting, is a powerful enabler of the process of strengthening demand for transparency, accountability, and good governance.

The high costs of ignoring real-time dialogue with citizens are becoming increasingly evident to governments. Several countries are taking the initiative to open their public sector data in electronic form for others to use, manipulate, and mesh with other sources for all kinds of applications and users. The trend in several leading countries is toward bringing higher value for citizens and businesses through partnerships in the delivery of e-services, toward treating citizens not as objects but coproducers of such services, and toward involving citizens in shaping and monitoring public policies. Cocreation is a key part of Singapore's "Gov-with-You" strategy, which leverages Web 2.0 technologies to facilitate two-way communications between a government and its citizens with regard to service delivery and citizen engagement.

The information and communication revolution presents an opportunity for a "second generation" development strategy that emphasizes an informed, inclusive and participatory development. ICT opens new options for development. ICT-enabled development draws on widely distributed information and communication to support grassroots innovation and collaboration. New tools like mobile phones and collaborative technologies enable more targeted and strategic communications, widely shared awareness of possibilities, peer and collaborative production, and broad participation in development programs. They facilitate local partnerships, enhanced experimentation, and local monitoring of development programs. They support community learning and knowledge sharing, network-based innovation, and the building of community-based institutions. They help promote access to health information and learning resources, and new ways to deliver extension and support services to small farmers and businesses.

A second generation e-development strategy would be based on a new phase in applying ICT for development, an "ICT4D 2.0" (Heeks 2008). This new phase shifts attention from preoccupation with technical novelty to contextual understanding of how existing technologies can be used effectively to solve problems of poor communities. It shifts the locus of innovation from supply-driven solutions to collaborative innovation that emerges from working with poor communities, and even more radically, to grassroots innovation that mobilizes and empowers communities to innovate by, and for, themselves. It shifts ICT initiatives from an exclusive focus on

investing in physical access to ICT, to taking a holistic approach that invests in local competency development to create and use content. It shifts emphasis from designing top-down blueprint plans to developing local processes and grassroots institutions that enable flexibility, beneficiary participation, local leadership, and local innovation and learning.

Yet, the transition to a bottom-up participatory development—leveraging shared national vision and policy directions with local initiatives and grassroots innovation—is never easy or without resistance. Existing power structures in public and private spheres are likely to hoard information and undermine decentralization. Changes in mindset about development, the locus of development efforts, and skills of development practitioners are key ingredients. Open leadership and open government demand new attitudes and skills for information sharing and collaboration—not just investments in ICT tools and networks. Policies to support information sharing and accountability, and investments in community organization, local institutions and collaboration platforms, and information and digital literacy are necessary complements to make the transition.

Participatory development also calls for supporting home-grown entrepreneurship, and rewarding initiative and risk taking. The ICT industry has been a major source of entrepreneurship, from ITES to mobile applications and information services. It has been the hotbed of social entrepreneurship, techno-entrepreneurship, and fastest growing enterprises. Networked cities are the hubs for learning, innovation, and creative industries (Castells 2000). ICT tools and access to information can empower small entrepreneurs, connect them to local suppliers and markets, and help them internationalize. ICT tools and networks enable wider participation by members of the diaspora to invest, mentor, and partner with local entrepreneurs. Promoting entrepreneurship and small ICT enterprises can thus create a virtuous cycle of participatory and dynamic development.

The Challenge of a Techno-Economic Paradigm Shift

The previously discussed examples of ICT-enabled transformation share common enablers or foundations: policies in support of information sharing, advanced communications infrastructures, digital and information literacy, experimentation and learning to harness the new technologies, public–private partnerships, user-driven content, collaborative innovation, mechanisms to manage change in processes and organizations, new attitudes and practices, and new institutions. Together, these enablers are facilitating a techno-economic paradigm shift.

These examples of ICT-enabled transformation also point to a broad and fundamental lesson of development: technology is much more than an ingredient in development strategies; it is an enabling tool and conditioning element of their viability. As technology changes, it opens new frontiers and sets conditions that generate development opportunities. Such development requires learning to benefit from opportunities arising from technological breakthroughs. A new technological

revolution creates major discontinuities and shifts in the direction of change, opening new paths to development and opportunities for learning and catching up. Taking a long-term perspective, each technological revolution is associated with socio-institutional transformation or techno-economic paradigm, and leads to a surge in productivity development (Perez 2002).

New growth theorists and economic historians have characterized GPTs as having: (1) wide scope for improvement and elaboration; (2) applicability across a broad range of uses; (3) potential for use in a wide variety of products and processes; and, (4) strong complementarities with existing or potential new technologies (Bresnahan and Trajtenberg 1995; Helpman 1998). GPTs are engines of growth. They play the role of "enabling technologies," opening up new opportunities rather than offering complete solutions. They act as catalysts, inducing complementary innovations in other sectors. While the steam engine is widely accepted as the GPT of the first industrial revolution, electricity is viewed as the GPT for the second industrial revolution.

Long adjustment periods are needed for an economy to fully reflect the productivity impact of a revolutionary new technology like ICT (David 2000). It is instructive to understand the dynamics of the productivity surge of the 1920s arising from electrification. In the case of the electric dynamo, the great productivity gains came not from the fact that electrical engines were faster and stronger than steam engines, but that they facilitated more efficient organization of work. It took decades for factories to be reorganized and for the full gains to be realized, but there were overall surges in productivity growth once a certain critical mass was reached. There are parallels between the interconnection of electric motors through grids—and the associated transformation in manufacturing practices—and the interconnection of computers via communication networks. The Internet, diffusing much faster in the USA than electricity did during 1880s–1920s, is a major step in this interconnection throughout local and global economies.

The ongoing ICT technological revolution is so profound and pervasive that it challenges many traditional economic concepts rooted in incremental thinking. However, the evidence in terms of economy-wide productivity has become most clear in the case of the USA (Jorgenson 2006; Jorgensen and Stiroh 2000; Oliner and Sichel 2000; Gordon 2000; David 2000; Brynjolfsson and Hitt 2000; Brynjolfsson 2009). The evidence of impact on productivity is even more compelling and persuasive across countries at the microeconomic, firm and industry sector levels. Although economists have had great difficulties measuring the productivity and transformative impact of ICT for some time, some leading economists now acknowledge the profound and continuing impact of ICT on productivity, economic convergence, the integration of the global economy (Spence 2011a, b).

The relatively recent adoption and low usage of ICT in many developing countries suggest that this revolution has not yet had a significant impact on economy-wide productivity, except among a few emerging economies. In order to have significant impact on growth, a country needs to have a significant stock of ICT or users in place, and perhaps be more advanced in using that stock for economic transformation. Most recent evidence on ICT contribution to growth comes from Korea, India, and China, best reflected in terms of their substantial exports in ICT industries.

Raising productivity through ICT use is essentially a developmental task that requires cumulative socio-technical learning and orchestrated investments in a combination of technological and social capabilities. Empowering the poor with ICT to increase access to information, learning, and employment opportunities also requires substantial experimentation, grassroots participation, social learning and strategies for scaling up, and sustainability.

As in earlier GPTs, the short-term impact (reflected in economy-wide productivity surge) may be uncertain or difficult to measure, but the long-term impact will be profound and typically has been underestimated in earlier revolutions. The lead time for ICT to have its full impact may be relatively shorter and the impact more transformative than for earlier GPTs. But advances in the technology are running far ahead of potential applications and the capacity of institutions and society to absorb and adjust to take full advantage of these technological capabilities. Moreover, the institutional changes and complementary innovations necessary for ICT diffusion and effective use in the public and educational sectors are likely to come at a slower pace than in business.

Each technological revolution provides a new set of general purpose, pervasive technologies and a corresponding set of new organizational practices for a significant increase in productivity in existing sectors, and this combined best practice is referred to as a techno-economic paradigm (Perez 2002). A techno-economic paradigm provides the means for modernizing all existing industries, activities, and infrastructures. This was the case with the deployment of the mass production paradigm in the twentieth century, and currently, the early phases of the ICT paradigm. A techno-economic paradigm articulates the technical and organizational model for taking the best advantage of the technological revolution and results in the rejuvenation of the whole productive structure. A techno-economic paradigm gradually defines the new best practice frontier and becomes the shared organizational common sense of the period.[9]

Each technological revolution encounters powerful resistance from established institutions and vested interests. The transition to the new practices is never easy and takes decades. It is best described by Schumpeter (1942) as a process of "creative destruction" where the established leaders are unlearning much of the old and inventing or adapting to the new. Matching and realigning the social and institutional environment to assimilate fully a technological revolution and its techno-economic paradigm involve painful changes, and at times creative disruption and destructions. Similarly, realizing the potential of the information and communication revolution requires revamping the productive structure, the building of new networks of institutions, the transformation of regulatory frameworks and governance, and even deep changes in ideas and culture.

Newcomers who understand the dynamics of the techno-economic paradigm shift can direct their efforts toward learning the new practices and may even find

[9]For example, in the era of car and mass production, the paradigm principles were mass production/mass markets, economies of scale, standardization, centralization, and hierarchies.

a route to leaping forward and catching up (Perez 2002). The "Asian tigers" took the leap forward with the microelectronics revolution, rejuvenated mature industries, and entered new and fast-growing industries. This involved intense learning and substantial investments in human capital and active absorption of technology. Similarly, development under the current techno-economic paradigm requires proactive and sustained efforts. According to this new paradigm, capacity to handle information, knowledge, and innovation will be more central than ever. This paradigm also calls for radical transformation in education and training systems, science and technology policies, and even more broadly, in conceiving development strategies.[10]

How Are Countries and Aid Agencies Responding?

A strong case can to be made for facilitating an ICT-based techno-economic paradigm shift by adopting a national e-transformation policy and strategy, based on theory and practice. However, there are many distractions and barriers to the effective adoption of national ICT policies, and to the sustained pursuit of long-term ICT strategies and programs. Neoclassical economists and sufferers of technophobia argue that no industrial or technology policy is needed or can work, either because market forces are adequate or because government failures are serious and inevitable. The ICT utopians and technology determinists are so driven by their excitement and aspirations about the dramatic advances in ICT that they are willing to invest in all sorts of pilots and component applications without strategy or preconditions—to "let a thousand flowers bloom." Here are some of the prevailing attitudes and responses.

Technological change and the ICT industry are driven by entrepreneurship, so leave it to the market or private sector, as skeptics of national ICT policy, innovation policy, and industrial policy would say. The neoclassical economists and technophobes suggest that policies for ICT (production and diffusion), like policies for industrialization and innovation, are best left to the private sector. They argue that ICT is driven by the private sector; governments cannot lead or add much value to this process, except perhaps by using ICT tools in government agencies to manage and deliver public services. Can governments and aid agencies really play a role in setting priorities and investing in emerging technologies in the context of an encompassing technological revolution? Can societies develop a national consensus on strategic priorities to advance e-transformation? Why pick ICT as a priority industry or a focus for technology innovation, as this would be akin to industrial policy?

[10]There is a significant risk that development practice will fail to appreciate the profound implications of the new techno-economic paradigm, and the need to respond in real time to the consequent challenges. An incremental and narrow perspective of development misses viewing development as a process of transformation, as a non-incremental paradigm shift, and as a discovery of new sources of growth and innovation.

The skeptics point to frequent government failures in pursuing industrial policies and "picking winners." They object to a government role, regardless of the labels used: ICT policy, innovation policy, or industrial policy—policies that stimulate specific economic activities or specific GPT that promote structural transformation.

However, a strong case be made for ICT policy as well as industrial policy, based on economic theory: there is no doubt that market failures exist and are often pervasive in developing markets (Rodrik 2008). The arguments for pursuing e-transformation policy are similar to pursuing policies for transforming education or any other complex national system—not just the "controversial" industrial sector policy. Asymmetric information results in financial market imperfections and reluctance to finance new and innovation-driven ICT activities that are risky and lack a track record. Investments in new industries and nontraditional areas need complementary services and inputs which are unlikely to exist before a substantial cluster emerges. Externalities, learning, and knowledge spillovers abound. Learning-by-doing and new-good-creation spillovers are at the heart of explaining growth in developing countries (new growth theory). These were essential to the wide adoption of high-yield variety in India's agriculture and elsewhere. Many investments in ICT infrastructures tend to be lumpy, requiring coordination; such investments play a similar role as investments in irrigation systems in supporting the diffusion of high-yield varieties. Development is fundamentally about structural change, producing new goods with new technologies, and this process is a fertile ground for many market failures. In sum, the opportunities for structural change and industrial upgrading brought about by ICT demand rethinking development and the role of government in facilitating ICT-enabled transformation (Lin 2011).

The arguments for sector policy are much stronger for ICT or the creation of the digital economy than for industrial policy in general—to capture supply-side and demand-side economies of scale, network effects, substantial externalities, and positive feedbacks or synergies that are prevalent in the ICT sector in particular (Hanna 2009a). Digital content providers cannot prosper without widespread connectivity and telecom infrastructure suppliers. e-Government cannot be inclusive and sustainable without a critical mass of users, and in turn, unless e-literacy, relevant content, and affordable connectivity and delivery channels are developed at the same time. Synergies create virtuous cycles in which initial government and private investments attract significant investments by other interested parties. The ICT services industry can thrive only when several appropriate ingredients for a healthy ecosystem are combined such as enabling environment, human resources, and communication infrastructure.

Economies of scale on the supply side offer opportunities to share information infrastructure (including broadband), share access to ICT, consolidate data centers, share information systems development, develop a critical mass of skilled human resources, and expand local capacity to produce and adapt ICT products and services. The new information economy is also increasingly driven by demand-side economies of scale or network economics (Shapiro and Varian 1999). The value of connecting to a network depends on the number of people already connected to it. This fundamental value proposition goes under many names: network effects, network externalities, positive feedback, and demand-side economies of scale. As the installed

base of users grows, the benefit for the users increases, and more and more users find adoption worthwhile. Once a critical mass of customer base is achieved, the market builds on itself with positive feedback and demonstration effects (Hanna 2009a).

Industrial policy skeptics may accept the need for policy intervention, but then insist that such polices have to be "horizontal" rather than preferential or sectorally targeted. Thus they would remain skeptical about industrial or innovation policies targeting ICT production or adoption—despite the potential pervasiveness of ICT as an enabler or GPT. Accordingly, market imperfections would be best remedied by uniform measures that target financial markets, education, and R&D. But horizontal incentives such as R&D subsidies and accelerated depreciation discriminate against small firms and labor-intensive activities. Policy makers therefore need to ensure that the activities favored are those that disproportionately suffer from the market imperfections in question (Rodrik 2008).

Despite these theoretical groundings for a government role in shaping ICT production and diffusion through policies based on addressing market failures, skeptics argue that government failures also abound, constraining any industrial or ICT policy in practice—there are informational, bureaucratic, and political constraints. The skeptics have thus often blocked any support to industrial and technological upgrading programs and ICT promotion strategies, at the World Bank and many other aid agencies, on the grounds of that they risk government failures. Yet most fast-growing countries, intentionally or not, pursue industrial policy in one form or another. This is true not only of Singapore, Finland, China, and Brazil, where industrial policies are openly pursued, but also Chile, Germany, UK, and the US, where industrial policies are common but less explicit (Justin Lin 2011).[11] A 2006 survey by UNCTAD shows that 44% of countries have adopted ICT plans, and 20% have actually designed such plans as part of their development plans and poverty reduction strategies.

Governments increasingly view ICT policies (and industrial policies) as imperatives to promote national competitiveness in an increasingly connected digital world, and are leaning to generate and implement policies needed to alleviate the consequences of market failures. Most societies do not view government failures in pursuing such policies to be inevitable and consider such policies as part of good governance. Government failures are taken seriously and their implications are thought through for the design of industrial, innovation, and ICT policy institutions. Countries such as South Korea, Singapore, and Taiwan did not have perfect institutions at their start of industrialization (or informatization), but pursued policies that overcame the market obstacles their investors faced in modern industries. These countries learned to improve their capabilities to design and implement these policies over time (Rodrik 2008; Hanna et al. 1996).

Focus on pilots and components, remain simple and small, and learn as you go. This is an attractive proposition since new advances like mobile phones (Apps)

[11] As economies in advanced countries struggle to maintain or restore growth in 2011 and beyond, industrial policies (and ICT and innovation policies) are likely to be brought under a brighter spotlight than ever before.

allow for small, cheap, quick development, incremental and modular improvement, and easy-to-use applications or pilots.[12] These developments, enabled by new mobile handsets with growing capabilities, are generating great excitement within the development community. They present affordable tools that can be available globally and quickly. ICT for development literature has thus been dominated by research and reporting on pilots, applications, and micro-level intervention.[13] So has been the focus of development assistance by NGOs, foundations, bilateral aid, and multilateral development banks.[14] The business and development literatures have also portrayed ICT as an endless stream of technological innovations—for consumers, businesses, or governments. It is tempting to focus on the latest tools and the "next best thing," to search for the silver bullet, to celebrate quick success stories, and to take credit for them.[15]

Yet there is growing awareness that scalability and sustainability are raising novel and inevitable issues. Perhaps less than 10% of such pilots become sustainable or scalable, particularly when they are donor-driven. Funding sources tend to be short term. Stakeholders critical to long-term sustainability are not engaged. Human resource capabilities become a constraint to scalability. Information sharing across applications, and integration across the value or supply chains are hindered by lack of interoperability. Enabling policies like privacy and reliability of information are missed. Ecosystems and capabilities critical to local innovation and sustainability are poorly understood and rarely established.

Earlier waves of ICT have generated similar excitements, and continue to shape and add to the tools for e-transformation. Telecenters are a prominent example. They were first promoted by ITU, and then by various UN organizations involved in rural development (FAO), small and medium enterprises (ILO, UNCTAD), health (WHO), information society (UNESCO) and many bilateral aid agencies (IDRC, CIDA, USAID), and to a lesser extent the World Bank and other multilateral development banks. Many of these telecenters have been piloted and financed by external donors, foundations, and NGOs, local entrepreneurs, or local communities, since they could also be started small, at low cost, and without much central or local government support. But as these telecenters strived to bridge the digital divide, add development applications, and reach out to the poor, they encountered problems of sustainability and scalability. As with the mobile wave, the short-termism and single-mindedness of aid agencies do not help in securing the scale, sustainability, and impact of telecenters.

The experience of the World Bank and other aid financing agencies is similar when it comes to adding ICT components to sectoral investment projects. The share of ICT

[12] Apps for development on mobile are multiplying with much promise for rural development, health, etc.

[13] This literature is best represented by the well-respected International Journal: *Information Technology and International Development.*

[14] InfoDev, a multi-donor financed program, with secretariat at the World Bank, has focused for many years on ICT pilots to demonstrate the value of various ICTs and business models. But the InfoDev program seldom worked to secure scalability and sustainability of such pilots and innovations.

[15] Many pilots, in India and elsewhere, were declared prematurely as success stories, but further independent evaluations proved otherwise.

components in World Bank lending has been growing faster than other sectoral investments, since the early 1990s. An early study by one of the authors suggested that these components were present in 60–90% of World Bank-financed projects, and add up to 5–10% of total lending (Hanna and Boyson 1993). That study highlighted that these components have become catalytic or critical to investment projects in almost all sectors and countries at different levels of development—improving macroeconomic management, as well as management information and communication systems, and the efficiency, responsiveness, and adaptability, and accountability of all investment programs. Even then, it was clear that the Bank, like other aid agencies, was reacting to a technological revolution with no clear sense of direction.

More recent quality assurance and audit studies have repeatedly shown that such ICT applications remain significantly lower in quality of design and implementation than the rest of the Bank portfolio. They lack any systematic integration into their sectors and institutions, and thus end up automating existing processes and isolated functions, rather than reinventing them or initiating and sustaining transformation of whole sectors and institutions. Their poor integration reflects the persistent disciplinary gaps between sector staff (in education, health, rural development, etc.) and ICT specialists (Hanna 2009a).

Focus on one element of e-transformation at a time, since each element is under one or more agency, and coordination of all elements of e-transformation is too complex and way beyond the capacity of most developing countries. At the national level, the focus has been on one single element at a time of e-transformation: telecommunications, ICT industry, ICT human resources, e-government, information policies, etc. Much of current development policy and practice treats elements of e-transformation in isolation. Yet, telecommunications, Internet, media, search engines, data mining and mashing, and business intelligence tools, and an exploding number of information technology applications continue to converge or become increasingly interdependent. Most of the documented failures of ICT applications in e-government, e-business, e-education, or rural development are traced to fragmented approaches that missed key enablers, operated within separate bureaucratic domains, and ignored synergies for sustained transformation and ecosystems for sustained innovation.

Consider the synergies between e-government and e-business, and other enabling conditions for e-transformation. Making e-government and e-business services broadly available to citizens and enterprises requires accelerating Internet penetration and affordable connectivity. And the take-up of online services depends critically on the development of digital literacy and an information culture. Education and the policy environment are keys to making technology work. Moreover, when governments tap domestic firms to act as partners in providing e-government solutions, they support private sector development in ways that can broaden e-development and create competitive domestic markets and learning opportunities for developing the local ICT industry.

The tendency to treat various elements of e-transformation in isolation is prevalent, but it must be overcome. Development assistance agencies tend to reinforce fragmented and ad hoc responses to the ongoing ICT revolution and its transformation imperatives. Responsibility for e-transformation within developing country governments is typically nobody's responsibility, or so widely distributed and fragmented as to lead

to the same thing. Ministries or agencies concerned with ICT, telecommunications, science and technology, innovation, small business, education, and all sectors concerned with applications are potential stakeholders, but are likely to protect their information and turfs, rather than adopt a whole-of-government approach to e-transformation. Thus, coordination failures and unexploited synergies are pervasive.

In practice, national ICT strategies have not been closely linked with overall development strategies, particularly in low-income countries (World Bank 2006, pp. 87–124). When linked to national development strategy, they tend to focus on ICT as an industry, but often neglect ICT as a cross-sector enabler and transformer. Even when such links are mentioned in planning documents, they are not rendered operational—seldom have the legal mandate and support, budgetary backing, institutional capacity for implementation, and monitoring and evaluation systems been implemented. They are left as good intentions then forgotten in practice. The reasons are many: scarcity of e-leaders, poor understanding of the links, low awareness and ownership of ICT among most public administrators, fragmented ICT applications by turf-bound sectoral ministries, weak involvement of core ministries such as finance and economic planning, and the pursuit of technology-driven agendas by ICT ministries or their equivalent.

But that is where national strategy and coherent policy for shared infrastructures, integrated investment programs, and systematic learning can have the highest payoffs. As a GPT, ICT is applicable to all sectors. Moreover, ICT payoffs are contingent on many other factors and coinvestments—in skills, infrastructures, policies, processes, institutions, and leadership. Integrative frameworks are needed to systematically define the key interdependencies and identify the stakeholders or custodians of various elements of e-transformation, and thus begin to manage or influence them. How comprehensive the action on various elements of e-transformation is would depend on informed analysis of where the binding constraints are, and where selective action would have the highest payoffs.

Other skeptics of national strategies argue that ICT continues to advance at breathtaking speed, posing insurmountable uncertainties and unpredictable trajectories that defy any strategizing at the national level. Just note the recent emergence and advance of wireless and broadband communications, mobile devices, search engines, Google maps, collaborative technologies and social networks, analytics and business intelligence tools, and cloud computing. Success is as much the outcome of serendipity and chance, as it would be of policy and planning, they say.[16] Can any national ICT policy or strategy be relevant, dynamic, or robust in the face of such technological upheavals? Can past experience, with old or current ICTs, be a reliable guide for future adoption of new ICTs?[17] Vendors and technology

[16] Note how the demand for programming to address the Y2K problem, and the overinvestment in telecommunications during the dot com boom helped the early growth of India's export of software services.

[17] The Independent Evaluation Group (IEG) of the World Bank has been reviewing the Bank Group's experience in implementing its ICT sector Strategy, which was adopted in 2002, as an input into The Bank's preparation of its next corporate ICT sector assistance strategy for the next decade, to be available in 2012.

consultants tend to push fads, the latest gadgets, and the "next best thing," while local users and procurement officers suffer from asymmetric information. Can this asymmetry be overcome? Some development practitioners go as far as suggesting that development agencies have "missed the boat" on the ICT revolution, and are unlikely to be able to catch up or match the fast-evolving needs and learning requirements of such a technological upheaval![18] In the same vein, some development economists argue that this is a "new world," where evidence-based policy and historical data do not apply, and where "Internet bubbles" and "irrational exuberance" are likely to recur—so, ICT strategy is at best uncertain, and due prudence suggests that aid agencies should keep it out of development thinking!

A good ICT strategy must have a long-time horizon, based on the best foresight available about technological trends. Yet, it must be flexible enough to continue to harness advances in ICT during implementation. Governments are engaged in setting open standards and enterprise-wide architectures for their public agencies so as to make it possible to readily integrate new technologies while securing interoperability and information sharing across the government and the economy. Some countries have learned to master successive waves of technological changes in ICT, via successive strategies and continuous learning. A dynamic e-transformation strategy should also develop foresight, innovation ecosystems, and learning capabilities to assess possibilities for leapfrogging to new technologies and to discover through experimentation what and how technologies can make sense in diverse local contexts.

What is e-Transformation?[19]

e-Transformation is conceived as a process of fundamental structural change, a shift to a new techno-economic paradigm, driven by a powerful GPT, ICT. ICT is enabling the transformation of all kinds of economic activities: financial services, manufacturing, transportation and logistics, education and health care, media and entertainment, public services, science and innovation, and more. At the national level, e-transformation policies and strategies are our means to facilitate and compress the shift to this new techno-economic paradigm. The guiding principles of e-transformation are decentralized integration, network structures, adaptability, agility, customization, knowledge capital, innovation ecosystems, transformational leadership, and synergistic and change management. At the level of an organization, e-transformation goes beyond automation of existing processes to encompass fundamental redesign and innovation of business processes and practices, the internal relationships within the organization, and the relationships between the organization and its stakeholders and operating environments.

[18] When it came to the ICT sector, "missing the boat" was an often-made remark by World Bank colleagues, since the advent of the Internet and the diffusion of personal computers.

[19] For those interested in full treatment of the concept of e-transformation and the broad implications of ICT for development and techno-economic paradigm shift, see Hanna (2009a).

e-Transformation stands for e-development, ICT-enabled development, information society, and knowledge economy, collectively. e-Transformation is about promoting a new development strategy paradigm, one adapted to the opportunities and challenges arising from ICT. It fosters deep changes in the economy and society brought about by the effective deployment and diffusion of ICT. These changes typically lead to increased production and use of information and communication; reduced cost and increased pace of transactions and interaction throughout the economy; empowerment of individuals, communities, and enterprises with connectivity and knowledge; and increasing the share of information-based production and services in the economy.

e-Transformation is a broader concept than *high technology* or the *new economy*. It is more linked to a knowledge-based, innovation-driven, competitive economy, and to an inclusive, learning, information society. But unlike the knowledge economy, which deals with the intangible resource of knowledge, it focuses on ICT as a focal point and takes a holistic approach to harness this technological revolution to transform the economy and society. This means acting on all elements of the e-transformation process—including policies, institutions, and capabilities to leverage the new technologies—and not just promoting the ICT industry or ICT investments.

e-Transformation is really more about the effective diffusion and use of ICT as well as the deep structural and capability changes in the economy and society that accompany ICT use and diffusion.[20] The ends of e-transformation should be guided by the overall development vision, goals, and strategy of the country itself: environmentally sustainable growth, elimination of poverty, effective and transparent governance, competitive and innovative economy, learning society, etc.

e-Transformation: From Why to How

Countries are learning to adapt and in some cases to smartly harness the ICT revolution to enhance their competitive position in various industries, improve governance and public services, and build an inclusive information society. Obviously there is much to be learned, in view of the fast pace of technological change, the emergence of the digital economy, the uncertain payoff of ICT investments, the malleable nature of ICT as a GPT, and the need for complementary policies and investments to realize the potential benefits. e-Transformation demands new policies, institutions, learning, and new types of leaders and change managers.

As during the early stages of all major technological revolutions, before large-scale diffusion or deep transformation occurs, experimentation and innovation are essential. There are no recipes or standard strategies that can be taken by early

[20]Progress with e-transformation should not be confused with e-readiness indicators. E-readiness indicators attempt to measure progress in the ICT sector and to some extent, its use in government and business. But e-readiness indicators do not tell the whole story, as they provide a static picture of inputs and outputs, and are not ends in themselves. E-readiness indicators provide measures of context and of initial conditions for ICT-enabled change.

adopters or fast followers. Countries and enterprises alike have to discover for themselves what this technological revolution means for their constituencies, markets, institutions, practices, and futures.

This book is concerned with how governments can meet the specific challenges of designing and implementing economic transformation through ICT. Some of the common challenges facing all countries are as follows: How to diffuse the adoption of ICT as fast, and tap its benefits as broadly as possible? How to ensure an appropriate mix of investments (in hardware, software, skills, institutional change) at the local and national level? What is the optimal path or sequencing among such investments? How to ensure appropriation and adaptation of the technology to diverse local contexts? What degrees of decentralization are necessary for different elements of e-transformation? What kinds of policies and institutions will be needed to facilitate coordination among these elements? What synergies can be tapped and how to identify them? What balance may be struck among various stakeholders (public agencies, private sector, civil society) and among various development objectives (growth, poverty reduction, sustainability) in designing e-transformation strategies? Case studies are used to illustrate how countries have attempted to address such issues.

This book sheds light on the above issues and contributes to the debate. The country case studies show the merits of pursuing e-transformation strategies at many levels. They show specifically how governments are partnering with the private sector and other stakeholders to pursue such strategies. These cases can shed light on new-style strategies that are adaptive and dynamic, in some cases pursued and adapted over decades, and in continuous consultations with various stakeholders.

In practice, national ICT policies and strategies do not come close to an idealized integrated e-transformation process. Most cases in this book (and its companion book: *Seeking Transformation Through Information Technology*) suggest that countries have a lot to learn to capture the economy-wide benefits of ICT. But these cases suggest that many countries are striving to design and implement such strategies, and are learning this new development game—drawing on their own experience, and those of early leaders and late bloomers. While there is no one common recipe, the book sheds light on key characteristics of effective strategy formulation and implementation of e-transformation, the instruments and policies being used, the role of various stakeholders, and the lessons learned. In such a fast but long race, even the most advanced among these countries cannot be content to rest on their own laurels.

Successful industrial policy practice as well as past failures point to some common principles for the practice of ICT policy and strategy. The specifics of industrial policy have varied and depended heavily on the circumstances and institutional capabilities of a country. Yet, there are some general principles that can be articulated about how institutions carrying out industrial policy should be designed to address market failures while minimizing government failures. Rodrik (2008) suggests that these principles should follow from three considerations: (1) the requisite knowledge about market and coordination failures, synergies, spillovers, and barriers to structural change is diffused—requiring mechanisms for eliciting information and for close collaboration among stakeholders, particularly government and private sector; (2) businesses have strong incentives to game the government—calling for market

discipline and strong safeguards against bureaucratic capture; and (3) the intended beneficiary of industrial policy is the society at large, not just government or business—demanding accountability. These considerations and principles are taken into account in interpreting the e-transformation case studies and drawing lessons in the last chapter of this book, as we shift from the why to the how of e-transformation.

Case Studies of e-Transformation

Despite the proliferation of national ICT strategies, these strategies and programs are typically communicated in planning documents in terms of their final design—in blueprint terms, not process terms.[21] That gives the impression of a highly controlled, deductive, linear planning exercise, starting from a comprehensive analysis and appraisal upfront and ending with a comprehensive investment program or project blueprint.[22] The reality is quite different. Like all development strategies, those related to e-transformation seldom emerge full blown or remain intact.

Examining e-transformation strategy formulation and implementation as a process through a case study can make important contributions to our understanding and practice. First, it offers a model for practitioners to reflect on their own practices, become participant-observers, and help contribute to multidisciplinary research on national ICT strategy. Second, it captures the political and institutional dynamics that shapes e-development strategies. Early political backing and coalition formation, timely mobilization of resources, dynamic negotiation of priorities, and sequencing of implementation are often neglected in the reductionist recasting of ICT application in development. Yet, these are critical aspects of strategy design, implementation, and sustainability. Finally, a case study of the strategy development process allows for contextual understanding of the linkages and interdependencies among the various elements of e-development.

Unlike common descriptions of national ICT strategies, these case studies go beyond static assessment of the knowledge economy and e-readiness to capture the dynamics of developing and implementing a strategy and of building partnerships within the country for e-transformation. They go beyond the typically long laundry list of recommendations for transforming a country into a knowledge economy. They reflect the hard choices and tradeoffs that must be made in designing and implementing e-development within real-life human, financial, and institutional constraints. They take account of initial conditions, stakeholder interests, institutional learning, and political dynamics.

The literature on country experience in developing and implementing e-transformation is scarce. With few exceptions, that literature is theoretical or

[21] National ICT strategies have been developed and adopted by many countries, particularly in preparation for and as a follow up to the World Summit on Information Society (WSIS) in 2005.

[22] For relevant discussion of the project cycle and its limits for nonengineering investment projects, see Hanna and Picciotto (2002).

descriptive. Descriptive literature typically depends on official statements of national ICT polices and strategies, with scant attention to implementation experience, evaluation, and lessons learned.[23] Even scarcer is the literature on cross-country or comparative experience in pursuing e-development or e-transformation. One such notable exception is a World Bank's review of national e-strategies (*Trends in "National E-Strategies: A Review of 40 Countries,"* Chapter 5 in World Bank 2006). However, this review was based on desk exercises of examining written e-strategy plans. Thus, it missed capturing the gap between blueprint design and implementation, the rich lessons to be learned from meeting implementation challenges, and the instruments used or created to meet these challenges. A relatively recent ITU review of national e-strategies also fails to make an evaluative assessment of the formal strategies and their actual implementation (ITU 2010).

One key contribution of this book (and the companion book *Seeking Transformation Through Information Technology* with the same coeditors) is that it draws on the in-depth observation of the authors who have been actors or participant-observers of the country they are reporting on. That gives these authors a position or perspective that can capture the *process* of formulating and implementing e-strategies and appreciate the underlying forces and dynamics that shape both design and implementation. Moreover, all cases follow a common conceptual framework, to facilitate cross-country comparisons of e-strategy design and implementation, without reducing country experiences into some aggregate measures of readiness or indicators of outcomes. This has not been an easy task, since most practitioners do not have much time to reflect on and evaluate such experiences. This is perhaps one contributing factor to the scarcity of such literature.

In-depth country experiences are indispensible in learning new practices, capturing tacit knowledge, and helping to build frameworks and theories. Case studies of country experiences convey a more realistic picture of the messy, creative, and emergent processes involved—providing researchers with a rich source for theory building and hypothesis testing, and providing practitioners with examples that capture best or promising practices. For thoughtful practitioners, case studies enrich their menu of the "how" and give them realistic assessment of the efficacy and limits of various instruments and innovations. For researchers and scholars, and when placed within an explicit framework, case studies show the role of conceptual models in guiding strategy design and implementation and point to the need for further elaboration or improvements on such models.

Case studies are also accessible to a broad audience of development practitioners, policy makers, and national and international development consultants and researchers—not just ICT and technology policy specialists. This broad audience is a primary target of this book. The chapters concerning specific country cases can be more concrete and contextual and thus more appealing than the first and last chapters, which are concerned with frameworks and comparative analysis.

[23] Individual country case studies have been covered in successive issues of the annual Global Information Technology Report, published by INSEAD and the World Economic Forum.

A Framework for e-Transformation

The unrealized potential of ICT as a transformational enabler calls for strategic, holistic, and innovation- and learning-based approaches. We advance the framework of e-transformation as an approach to pursue coherent policies and mutually reinforcing ICT-enabled development initiatives at the national and regional levels. The e-transformation framework helps identify and influence key stakeholders to help create an "ecosystem" for the knowledge economy. It is a holistic approach that generates shared visions and mobilizes stakeholders. It both maps the connections and shapes the relationships among diverse players. It facilitates the creation of national consensus on e-transformation, and systematic thinking about ICT as enabler of development.

e-Transformation can be conceived as composed of key, interdependent elements: an enabling policy and institutional environment, shaped by shared vision, long-term strategy, and institutional leadership; an affordable and competitive information infrastructure; a dynamic ICT industry and innovation system that can adapt the technology to local needs and capture export opportunities; a broad ICT literacy and technical education, and techno-entrepreneurship to harness and master ICT potential; a coherent investment program to apply ICT to modernizing the public sector; and incentives to promote the effective use of ICT for developing the private sector and empowering civil society (Fig. 1.1).[24]

Institutions leading long-term e-transformation strategies are at the heart of orchestrating and implementing all elements of the transformation process. Countries need to learn to develop the necessary governance and institutions to engage stakeholders and forge national consensus around an e-transformation strategy and its implementation mechanisms. What should be the mandate, authorizing environment, and core capabilities of such institutions? How can countries minimize government failures and yet address market failures? What capabilities and incentives would be needed to strategize, implement policies, partner with the private sector, build alliances, and engage key stakeholders, without being captured by rent-seeking elements of the business communities? How can these institutions prioritize, sequence, and coordinate investments, to respond to development crises and imminent opportunities, yet be guided by long-term goals and visions?

The concerns of these leading institutions are not limited to the internal coordination and implementation of ICT sector policies and investments. They must extend to articulating visions of e-transformation that support and align with the long-term development strategy and goals of the nation. Such alignment is often absent or weak. How did leading countries fashion such integrating institutions? Did these institutions and strategies arise in response to compelling visions or national crises?

[24]The figure is a highly simplified representation of the key enablers and application areas of ICT and the many possible interdependencies among them. The first four elements are the enablers to the effective use and wide diffusion of ICT in government, business, and society. For more detailed analysis of each element and their interdependencies, see Hanna (2009a).

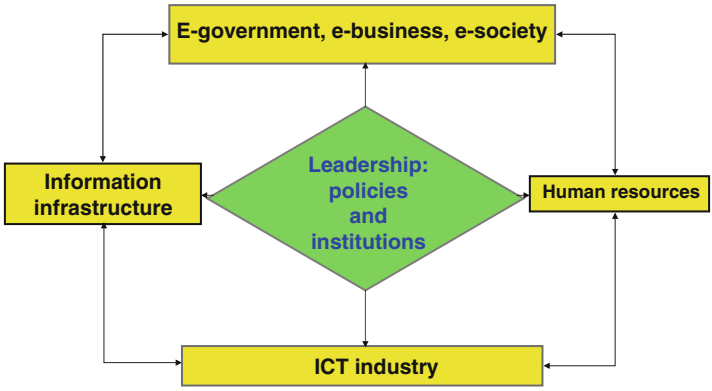

Fig. 1.1 Simplified links among key elements of e-transformation (for a concrete example of designing such an e-leadership institution, see Hanna (2008). For examples of the variety of e-leadership institutional models that have been crafted by developed and developing countries, see Hanna (2007b). On institutional innovation, see Rodrik (2007))

Did they aim to support an open, networked, learning and innovative economy? Did they develop information sharing policies, open digital platforms, and ICT diffusion programs to promote inclusive growth and participatory development? Did they harness ICT for energy management and environmentally sustainable growth?

A second core element of the e-transformation process is the human resources and learning systems. e-Transformation hinges on ICT education to research and adapt the new technologies, ICT skills to operate and maintain information systems and infrastructure, managerial understanding of the information and communication requirements to build responsive and learning organizations, leaders to manage change in processes and institutions as they adopt ICT-enabled business practices, and e-literacy for society at large to harness digital intelligence and participate effectively in an information and learning society. Did some countries choose to leverage ICT to reform and transform the education system at large? Are there specific managerial practices that can facilitate e-transformation in government and the private sector and wring the maximum productivity from ICT investments? How did the leading countries like Singapore and Finland promote learning and innovation in ICT? How did they acquire the new skills and encourage deep assimilation through partnerships among local businesses, universities, MNCs, and the diaspora?

The third core element, the ICT industry and innovation ecosystem, is the engine for technological change, for diversifying the economy, and for exporting high-value ICT products and services.[25] All countries in this book—as well as many other industrial and developing countries—developed specific incentive policies and innovation ecosystems for the ICT sector and related industries and services.

[25]For more detailed treatment of the role of the ICT industry in e-transformation, see Hanna (2009a, 2010).

Did they target ICT multinationals or local and small ICT enterprises? How did they encourage spillovers, technology transfer, and partnerships among MNCs and local ICT companies? How did the governing and promoting institutions gain the requisite knowledge about spillovers, market failures, and constraints that block ICT innovation and diffusion in the economy? How did these countries nurture and respond to the special needs of ICT as an infant industry? How did they nurture specialized ICT innovation ecosystems? Did some countries leverage ICT to open up their national innovation system and improve interactions among all its players? Why did some countries succeed and others lag behind in ensuring that the benefits from nurturing ICT industry capabilities accrue to the society at large?

The fourth element is building a dynamic and competitive information infrastructure. This is a leading element on which information access and sharing, and much of ICT systems and application benefits depend. In many lagging countries, absence of a dynamic and competitive information infrastructure has been the binding constraint. Underdeveloped information infrastructures have also limited the benefits from network effects, e-business, and e-government applications, and in countries with large rural populations, reinforced the economic and rural–urban divides. How did countries like Singapore and Finland compress the development of their advanced information infrastructures to become the most connected societies? Why did South Africa and the Philippines lag behind in securing investment in a competitive communications infrastructure? What promising approaches are they exploring to bridge their digital divides?

Finally, the most pervasive element of e-transformation is the application of ICT in all sectors of the economy, in public, private, and civil society institutions. Most countries, developed and developing, are seeking to use ICT to improve governance and the delivery of public services. But performance varied widely in reaping benefits from such investments. Countries like Singapore pioneered the use of ICT in government, first to modernize and enhance the efficiency of the civil service, and increasingly to syndicate all kinds of public and private services, practice open and smart government, and change the interactions with business and the public and personalize all services. Why did countries differ in using and diffusing ICT to transform government and business? What lessons can be learned about programs to diffuse ICT among small and medium enterprises?

Collectively, these elements—or foundations—of e-transformation cover the package of policies, investments, and institutions that enable an economy to master and diffuse ICT for social and economic development. At the heart of e-development are e-leaders and e-leadership institutions—individuals, networks, and institutions that develop a vision of an information society, set policies and priorities, seek to forge national consensus on reforms, and create and coordinate synergies among the elements of e-development. To succeed, leaders should act in sync on many fronts: build the communication infrastructure, human resources, ICT innovation system, policy and institutional regime, and ICT use and diffusion throughout the economy.

The proposed e-transformation framework is inevitably a simplified view and stylized depiction of a complex process involving tacit knowledge and rich experience. We use the proposed framework to glean the strands of causal order and key

synergies underlying what may seem a chaotic process and to structure the unwieldy mass of historical events into a meaningful sequence of change and transformation. This framework is mainly a heuristic device or conceptual model, not a straightjacket to be forced upon the infinite richness of real life and the real journey of each country toward an ICT-enabled and transformed economy.[26]

Country experiences can be analyzed and assessed, and gaps and weaknesses can also be identified using the e-transformation framework.[27] Thus, all country case studies of this book examine national ICT strategies through the lens of this framework. They demonstrate how the e-development framework has guided—or might be enlisted to guide—the design and implementation of national ICT-enabled development strategies.

Integrating e-Transformation into Broader Strategies

The e-transformation framework aims to integrate ICT into development strategies by placing ICT interventions within a broader development context and making them meaningful to policy makers.[28] It facilitates the process of creating a shared and energizing vision of how a society will harness the ongoing ICT revolution to access knowledge, address development priorities, and meet competitiveness challenges.

By tightly linking national ICT strategies to broader development visions and strategies, the holistic e-transformation strategy engages policy makers in driving the ICT agenda in response to national development priorities—rather than the other way around. It helps focus the attention of policy makers and program managers on ICT-enabled development results. ICT becomes an enabling force for pursuing

[26] This framework can help both explain and guide e-transformation as a process enabled by ICT, in a similar way as Porter's system of competitive advantage (Porter 1990; Heeks 2006) is used to both explain and guide the design of programs to enhance national competitive advantage. Porter's competitive advantage theory takes a holistic and systemic view of four elements or determinants: factor conditions; demand conditions; related and supporting industries; and firm strategy, structure, and rivalry. It views these elements together as a mutually reinforcing system. These elements and their interrelationships are continually evolving. The proposed e-development framework functions in the same fashion to explain the dynamics of ICT-enabled development and to guide the design and strategic management of ICT4D programs.

[27] The value added of this framework has been validated, among others, by a case study of e-Sri Lanka–a comprehensive e-development program already underway for several years, with World Bank assistance (see Chapter 5 in Hanna and Knight 2011). The experience of using an integrated e-development framework to guide the design and implementation of e-Sri Lanka and capture lessons of implementation is documented elsewhere (Hanna 2007a, b). The World Bank has since applied this framework to its assistance in a number of other countries such as ongoing Bank-financed projects for e-Ghana, and e-Rwanda.

[28] Little theory or research has linked concepts of development studies to ICT-for-development research (see Heeks 2006).

policy reforms. Enlightened leaders become engaged in shaping this vision and in using it to build consensus on institutional and economic transformation.

The e-transformation framework reframes what were typically seen as specialized technology debates, isolated ICT interventions, and separate infrastructure investments—it sets them within a broader whole as an integral dimension of the country's development strategy.[29] Considered holistically, these interventions can be linked to a broad development vision that keeps the focus of debate on development outcomes and the focus of program design on linking means to ends. Rather than assuming causality between individual elements of e-development—such as connectivity, content, e-literacy, and e-government—and development outcomes, these elements are strategically combined to coproduce such outcomes.

The case studies illustrate the links the countries involved tried to establish between ICT strategy and their overall national development and competitiveness strategy. The institutional mechanisms for doing so are rarely in place and vary in quality. e-Leadership institutions, integration mechanisms, and consultation forums are critical to making e-transformation central to sectoral and cross-sectoral strategies. How did these countries pursue such integration?

Taking Account of Interdependencies; Exploiting Synergies

The interdependencies among e-transformation components are significant in advanced knowledge economies and even greater in developing and emerging economies. Studies in OECD countries indicate a strong link between ICT investment, productivity, and competitiveness (OECD 2004). Moreover, they show the significance of "interaction effects"—for example, interactions between ICT investment, infrastructure, skill levels, and the policy environment (Economist Intelligence Unit 2004). A critical mass or minimum threshold of ICT development can have a significant positive impact on a country's economy. Integration offers many opportunities for tapping synergies among the elements of e-development and reaping returns to scale when investing in information infrastructures.

For a developing country in particular, with circular and multiple causation for information poverty (Hanna 1991; Myrdal 1957), the impact of one element of e-transformation is heavily dependent on progress in others. Investments in ICT must be accompanied by investments in human resources, process innovations, institutional changes, and policy reforms to fully realize the potential benefits. This is consistent with a key lesson of development experience in general, that is, the need for a comprehensive approach to development (Hanna and Picciotto 2002). The case studies explore the attempts of various countries to capture and manage these interdependencies over time, and show why some succeeded and others failed to exploit the potential synergies.

[29] On the issue of reframing, see Wilson (2005).

Engaging All Relevant Stakeholders

National ICT strategies typically describe plans and initiatives in lifeless and bureaucratic terms, devoid of actors and stakeholders. They make little use of coalitions, partnerships, stakeholder participation, social interactions, governance mechanisms, conflicting interests and perspectives, power relations, pull platforms, and authorizing environments. Yet these factors drive the success or failure of efforts to diffuse ICT (Hanna 2009a, b; Wilson 2005).

Adopting an e-transformation framework, policy makers and strategists are expected to think holistically about all key stakeholders of an information society. This framework, combined with stakeholder analysis tools, can be used to map the connections, shape the relationships, and coordinate the work among diverse players.[30] They can help clarify the roles of the government, the private sector, civil society, academia, and aid agencies, with the aim of building partnerships among them. Over the medium term, this framework helps transformational leaders tap the interdependencies among the actions and resources of different stakeholders and champions to realize a shared and compelling vision.

Balancing Top-Down Direction with Bottom-Up Initiative

The e-transformation approach promotes systems thinking or "ecosystem thinking," that is, the development of an environment that enhances innovation, scaling up, and sustainability. Centrally driven programs need to be complemented by bottom-up initiatives, creative partnerships, and grassroots empowerment. National policies and institutions matter for creating healthy ecosystems and for enhancing developmental payoffs of local initiatives. And local initiatives accelerate learning, facilitate adaptation and coordination, and promote innovation and diverse experience on the ground.

The balance between centrally driven programs and locally driven initiatives will vary depending on a country's size, the diversity of its regions, and its tradition of political and administrative centralization. But since ICT is a new dimension of development and a malleable GPT, the balance should favor mechanisms to empower grassroots organizations, promote local ownership and innovation, ensure local fit and flexibility, and meet the special needs of communities.

Balancing Short- and Long-Term Objectives

Current documentation and reporting of national ICT strategies do not capture the dynamics of implementation, and the multiple learning and feedback channels that

[30] For detailed description of such stakeholder tools and their role in strategies for engaging stakeholders in design and implementation, see Hanna (2009a). For a country case study of how this is done in practice, see Hanna (2007a, 2008).

shape implementation. Also, they do not capture the difficult tradeoffs between responding to short-term imperatives and staying the course on strategic and foundational investments. The country case studies in this book attempt to capture the dynamics of formulating and implementing these strategies. Policy makers and e-leadership institutions face tremendous pressures to attend to quick wins and visible interventions, to diffuse resources across many initiatives, and to limit attention to short-term political horizons.[31] In particular, newly established ICT agencies are likely to face a diversity of legacy systems, backlogs of demands from powerful ministries, and resistance to establishing government-wide standards for ICT investments, and architecture.

A holistic e-development strategy needs to strategically balance and orchestrate the ICT investment portfolio, to give a sense of quick payoffs, while progressing toward sustainable transformation. It gives due attention to the less tangible investments that take a long time to yield results—such as the development of e-literacy, e-leadership, e-policies, e-institutions, core competencies, and ICT human resources—but that are fundamental to sustainable e-development. Short-term quick wins, deemed necessary for political sustainability, need to be balanced with long-gestating investments necessary for economic sustainability. How can a country maintain an appropriate balance between responding to political pressures for quick fixes and visible short-term milestones, and achieving sustainable change and long-term objectives of e-transformation?

Building Flexibility and Learning into Strategy

National ICT strategies are often conceived of as detailed, long-term investment plans, to be centrally financed, monitored, and controlled. Their outcomes are monitored largely through ICT indicators, which focus mainly on intermediate outputs such as teledensity, and information traffic flows. But there are big gaps between access to ICT and its use.[32] Moreover, establishing causality between interventions and changes in development impact indicators is difficult, as many other factors come into play, most of which can be understood only in the local context.

ICT is a new and fast-changing technology, and diffusing it across diverse social and economic settings requires contextual adaptation, and continuous experimentation and learning. e-Development programs have to be flexible. Innovation, learning,

[31] At times quick wins are driven by an economic rationale and the need to learn, build user capacity, and sustain confidence in a program. Politicians may also prefer smaller, citizen-oriented initiatives that have lower risks and fewer implementation problems. Here, however, the discussion focuses on tensions and tradeoffs between high-impact but long-gestating investments and low-impact but short-term initiatives.

[32] There are several methodologies for measuring e-readiness, developing aggregate indices of readiness, and ICT indicators. The trend is to move beyond measures of ICT inputs to measures of ICT use and outputs. Several international institutions have devised such measures: World Bank (World Bank Institute), ITU, UNCTAD, and World Economic Forum, among others.

monitoring, and evaluation should be central functions and critical success factors. The need for flexibility and adaptability in e-development demands an emphasis on social learning, user-driven innovation, and participatory monitoring and evaluation. The case studies attempt to illustrate some of the approaches and mechanisms involved in facilitating adaptation and learning among the effective adopters of e-transformation, and the absence of such mechanisms among the slow adopters.

Overview and Organization of This Book

The book focuses first on two small, advanced countries that have been pursuing e-transformation for some time: Singapore and Finland. These countries are selected to capture the dynamics and impacts of e-transformation that become clearer only over a long time horizon. Their design and implementation of e-transformation come closest to the idealized framework outlined above. They demonstrated capacity for technological learning and innovation, to catch up and move to the frontiers. They provide evidence of development outcomes and competitive impacts of pursuing a long-term and holistic e-transformation strategy. Finland's GDP per capita grew from $11,250 in 1985 to $51,320 in 2008, while Singapore's grew from $6,490 to 37,600, for the same period (World Bank 2008). This growth performance is derived from early promotion and adoption of ICT throughout the economy, combined with continuous upgrading of human resources.

Singapore has been transformed by successive ICT-driven strategies, pursued over 3 decades. Finland is an example of a small country that transformed itself within 2 decades from a resource-intensive economy facing a crippling economic crisis to a knowledge economy driven by the information and communications sector and having one of the highest levels of innovation and competitiveness in the world. Both countries have small populations of around five millions. Both countries developed broad national commitment to harness the ICT revolution for a networked, learning economy. Both anticipated and seized opportunities opened up by the ongoing technological revolution. Yet, Finland is vastly different from Singapore in terms of its liberal democracy, political institutions, and leadership practices. And while Singapore used MNCs to build its innovation, learning, and ICT-based transformation capabilities, Finland relied on indigenous technological and institutional innovation.

The other pair of countries represent middle-income countries, but with challenging digital and economic divides: South Africa and the Philippines. South Africa is an interesting case of an economically divided country: partly highly developed, partly underdeveloped. Poor telecommunications policies have reinforced this divide, notwithstanding early visions and high aspirations of an inclusive information society. Highly developed ICT industries and technological capabilities were not matched with policies and programs to leverage and diffuse ICT, enable

local users to appropriate and adapt the new technologies, and promote an inclusive information society. The case promises rich lessons in the political economy shaping the information society.

The Philippines is an economically divided and geographically disbursed country, but with many ICT-enabled opportunities for outsourcing and for communication-based economic integration. The case study presents a country at a crossroad, where ICT offers a new paradigm for genuine development and new ways to address old and persistent problems. It offers a glimpse of an ICT-enabled Philippine society—enabled by mobile communications and applications that promote innovation, participation, decentralization, transparency, and governance. Like the South Africa case, the Philippine case shows the crucial role of leadership and institutions in bridging the huge gap between the transformative potential of ICT and current deployment of the new technologies and accompanying practices.

This book does not cover a representative sample of countries, but, together with a companion volume (Hanna and Knight 2011), shares a stratified one, as we strived to include countries at different levels of development, different sizes of population, and different political systems, from different continents. The book does not include only frontrunners, such as Finland and Singapore, but also recent followers facing continuing challenges of a digital divide, such as the Philippines and South Africa, so we can capture lessons from countries at different stages of e-transformation. Despite different levels of implementation and performance, a key common thing among them is their aspiration and systematic search for e-transformation. Thus, they have interesting experiences and lessons to tell.

The final chapter conducts comparative analyses along key e-strategy design and implementation issues for the four countries covered in the book. The key issues include the degree of centrality, linkage, or integration of e-transformation into the country's development strategy; search for comprehensiveness, synergy, and coherence of the strategy; and attention to e-leadership, stakeholder engagement, and institutional mechanisms for implementation. They also cover the balance taken between top-down direction and bottom-up initiative, between pursuing long-term and short-term objectives, and between ICT as a cross-sector enabler and as an industry or sector on its own. The final set of issues or criteria for comparing e-strategies includes degree of reliance on innovation and adaptation during implementation, emphasis on monitoring and evaluation or measuring outcomes, and attention to the digital divide and social inclusion. Lessons are organized along these key design and implementation issues.

Most countries are still at early stages of their e-transformation journey, and have much to learn from within, from each other, and particularly from the pioneers. No framework or overarching theory can substitute for this process of experimentation and self-discovery, which is also an intrinsic part of e-transformation. We hope this book can help countries share the policy lessons and discoveries arising from their exciting journeys.

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