ADB

TECHNICAL NOTES

Moving Toward Knowledge-Based Economies: Asian Experiences

Asian Development Bank

TECHNICAL NOTE

Moving Toward Knowledge-Based Economies: Asian Experiences

The views expressed in this paper are those of the authors and do not necessarily reflect the views and policies of the Asian Development Bank or its Board of Governors of the governments they represent.

September 2007

Regional and Sustainable Development Department

Asian Development Bank

ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
APCTT	Asian and Pacific Centre for Transfer of Technology
APGEST	Asia-Pacific Gender Equity in Science and Technology
APSTC	Asia-Pacific Science and Technology Center
ASEAN	Association of Southeast Asian Nations
DOT	Digital Opportunity Taskforce
EU	European Union
GIS	geographic information system
ICT	information and communication technology
IDRC	International Development Research Centre
KAM	knowledge assessment methodology
KBD	knowledge-based development
KBE	knowledge-based economies
KM	knowledge management
MNC	multinational companies
MSC	Multimedia Super Corridor
NGO	nongovernment organization
NIS	national innovation system
ODA	overseas development assistance
OECD	Organisation for Economic Cooperation and Development
Peacesat	Pan-Pacific Education and Communication Experiments by Satellite
PFNet	People First Network
PRC	People's Republic of China
R&D	research and development
ROK	Republic of Korea
S&T	Science and Technology
SEC	Securities and Exchange Commission
SMEs	small- and medium-sized enterprises
UHM	University of Hawaii at Manoa
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
US	United States

FOREWORD

At the Asian Development Bank's (ADB) 39th Annual Meeting in 2006, a seminar was held on knowledge-based economies (KBEs). The seminar was well attended. The key message from presenters was that developing countries that fail to transform effectively into knowledge-based economies will fall further behind more advanced countries, widening the disparities between developed and developing economies. To succeed in this increasingly competitive and global economy, countries must have advanced information and communication technology infrastructure, a highly educated workforce, dynamic research and innovation programs, and supportive regulatory environment. ADB and its shareholders need to understand the ingredients of the global knowledge economy and develop better methods to help local Asian countries become players in emerging KBEs.

With this in mind, we requested Prof. Dr. Serafin Talisayon of the University of the Philippines' Technology Management Center to review existing literature on KBE and review country initiatives with respect to KBE initiatives and approaches. Contributions to this paper have been made by Daan Boom, principal knowledge management specialist at ADB; David Sobel, senior results management specialist, East Asia Regional Department; Luigi Bodda, senior energy specialist, Pacific Regional Department; and Jun Tian and Ian Anderson, both advisors, Regional Sustainable Development Department. I would like to thank them for their contributions to this paper.

Shyam Bajpai
Acting Director-General
Regional Sustainable Development Department
Asian Development Bank

EXECUTIVE SUMMARY

Something new is happening in local Asian economies.

An Indian farmer checks online the latest prices of farm produce, helping him make better decisions—thanks to e-Choupals that connects rural farms to commodity markets in India and abroad. A seaman from Tuvalu sends dollars back to his family—thanks to the Tuvalu Maritime School that builds upon indigenous Tuvalu aptitudes for seafaring. A Shakti Amma, a woman entrepreneur, has reached new income levels, and with it new confidence and pride—thanks to Shakti Community, a rural marketing system that leverages on existing local social networks.

Give a man a fish, and you feed him for a day. But teach a man how to fish, and you feed him for a lifetime. Provide him with technology and market linkages and you feed an entire region. The old development metaphor becomes—using the new language of the knowledge economy—the enhancing human, structural, and stakeholders' capital. New ideas or intellectual capital, more than savings or investments, are the new keys to prosperity and to the wealth of nations.

An example of how important knowledge can be in the development of countries is cited in the *World Development Report* of 1998/99. Ghana and the Republic of Korea started off with almost the same gross national product (GNP) in 1960. Thirty years later the Korean GNP had risen more than six times. Half of the gap could be explained in terms of traditional factor inputs, the other half, according to the World Bank report was attributed to "knowledge" as a factor of production. Although knowledge has always been important for development, the concept of knowledge-based economies (KBE) gained awareness when the Organisation for Economic Co-operation and Development (OECD) published in 1996 its report on KBE. KBE is now generally regarded as a meaningful economic concept, one worthwhile pursuing. At the same time it is seen as yet to be a proven successor to the industrial economy.

The past 10 years have seen a wide variety of visions, ambitions, concepts, strategies, policies and initiatives aimed at introducing and advancing the KBE. However, most people involved—both academicians as well as practitioners—would today still characterize the KBE as a largely theoretical concept for economic growth and wealth creation. This is believed to be the case due to the absence of a common—globally understood and accepted—framework for the KBE and a set of measurable models and indicators for successful performance. KBE is however becoming more and more explicit, but for it to become a full reality, significant progress still needs to be made.

Adding to this, next to all the positive effects of worldwide growth and wealth creation the KBE is envisaged to bring forth, many economists now also point out the potential downsides of such an economy. Downsides are expected to occur once it becomes clear that substantial investments (e.g., in education and innovation) may not always lead to worthwhile economic growth and wealth creation, as new and unforeseen mechanisms—such as the offshoring of knowledge—may prevent the KBE from realizing its full potential, i.e., of sustainable levels of economic returns and of competitive advantage.

It is gradually recognized that the KBE may well develop, at least to some extent, into a globally disruptive economy for those "welfare" states and companies currently enjoying a leading economic and competitive position. Hence, attention is increasingly drawn to a kind of "leapfrogging" effect, which is beneficial to those developing economies intending on gaining a

globally competitive position. This effect occurs once these economies recognize that most commercially viable knowledge is of such a nature that it can more or less easily be “bought” everywhere in the world at low costs, from (highly) educated people, possessing a strong work morale and a flexible attitude. It is even envisaged that knowledge can eventually become a means of mass production—similar to manual labor in the industrial economy—once web-based information and communication technologies (ICTs) have reached worldwide penetration levels, allowing individuals to work and provide routine knowledge in a virtually networked (global) environment. This situation seems yet to be far off from current-day reality, but many countries in the developing world are making rapid progress to become knowledge-based (Finland, Republic of Korea, Singapore, New Zealand, Taipei,China) and some developing countries have started initiatives to become knowledge-based (People’s Republic of China, India, Malaysia). These developing countries have drafting plans which enable them to fully benefit from the mass production of knowledge. To counteract this, short-term protection measures may occur, once countries and organizations find it difficult to sustain their existing competitive advantage. After the initial focus of the KBE on creating an ICT environment, the current focus has moved toward knowledge-based development (KBD) or identifying and realizing the constituent elements of a social infrastructure which is supportive of the rapid creation, application, and commercialization of knowledge for sustainable development. A durable KBD can only be realized through linking the ”internal social cohesion” of countries to their ability in stimulating, developing, and nurturing education; research and development; entrepreneurship; networks and ICT infrastructure; and provision of seed capital and intellectual property rights. Over the years, these ingredients have become recognized as being essential for KBD.

CONTENTS

I. THE IMPORTANCE OF THE KNOWLEDGE-BASED ECONOMY: AN OVERVIEW

A. Introduction

1. The global economy is changing, and along with it, the landscape of economies in Asia.

2. A trend that started in the early 20th century continues to hold, namely, increasingly greater value is being created by national economies from services than from industry or agriculture.[1] Wealth creation through application of human knowledge and creativity is steadily outpacing wealth creation through extraction and processing of natural resources. Knowledge has increasingly become an important means for value creation.

3. In recent years, market values of private corporations often greatly exceed book values. The capacity of business corporations to earn can no longer be attributed mainly to its tangible assets but more to its intangible knowledge assets. Knowledge has increasingly become the repository of value. While this is happening, the knowledge content of goods and services is increasing as manufacturing is "dematerializing"[2] and economies are becoming "weightless."[3]

4. Globalization and the information and communications technology (ICT) revolution are creating increasingly atomized, but ubiquitously networked, economies and societies. Because of the behavior of information and knowledge as economic goods, and because of network externalities, dramatic changes, differentiations, and synergies are emerging in the modalities of creating value.

5. In short, national economies are becoming more knowledge-based—economies where productivity and growth have become more dependent on knowledge. It can be noted, though, that these global trends were largely unplanned. Nations, organizations, and individuals did not intentionally design the "knowledge era," they were—knowingly or unknowingly—pushed into it.

6. For the past 3 decades, despite various political and financial crises, East Asia had consistently been a high-growth region. India and the People's Republic of China (PRC) will be claiming their increasing slices of the world economy and in about 2 decades, the PRC's economy is expected to be the largest in the world.[4] The Asian economic landscape will continue to be pushed also by Japan and by smaller but bright, economic performers such as Republic of Korea (ROK), Malaysia, Singapore, and Taipei,China.

> *"The most important wars of the 21st century will be fought no longer on the physical battlefield, but in corporate boardrooms, laboratories, stock exchanges, classrooms, and shop floors."* – Fidel V. Ramos, former President of the Philippines

---

[1] World Bank. Various years. *World Development Report*. Washington, DC.

[2] Stewart, Thomas A. 1997. *Intellectual Capital, the New Wealth of Organizations.* Currency.

[3] This descriptive term was suggested by Prof. Danny T. Quah of the London School of Economics. Available: www.unesco.org/courier/1998_12/uk/dossier/txt11.htm.

[4] The Washington, DC-based Center for Economic and Policy Research anticipates that the People's Republic of China's (PRC) gross domestic product (GDP) at purchasing power parity (PPP) will begin to surpass that of the United States (US) by 2015, based on 7% annual growth of the PRC and US growth projections by the US Congressional Budget Office. Available: www.cepr.net/documents/publications/ss_defense_2005_04.pdf. On the other hand the Institute of Technical and Quantitative Economics of the Chinese Academy of Social Sciences, also using GDP (PPP) projections, expects that this to happen by 2030. Available: www.asiabiotech.com/01/english/preserved-docs/0105/0128_0130.pdf

B. Objectives of This Paper

7. Asian governments have been taking cognizance of how the international community is moving to one where knowledge has become the strategic national and organizational resource.

8. This paper aims (i) to examine the assumptions behind and ingredients of a knowledge-based economy and society and (ii) to survey how Asian governments have been planning to move their economies and societies to be more knowledge-based.

9. The first part of the paper examines concepts and underlying assumptions about knowledge and knowledge-based economy (KBE). The paper starts by identifying some important changes in perspectives or mental models on the part of decision makers and policy makers that are essential for gaining understanding and appreciation of KBE. It presents two overlapping development concepts: KBE and knowledge-based development (KBD).

10. It then proceeds to discuss four areas of governance for facilitating and creating opportunities toward a more knowledge-based economy and society. These areas have also been recognized as the four pillars of a KBE:

(i) Education, including building a skilled workforce;
(ii) National innovation systems, including science and technology, research and development (R&D);
(iii) Building networks, including ICT infrastructure and social networks; and
(iv) Policy and regulatory environment.

11. The third part of the paper surveys selected initiatives and good practices of six Asian countries along the four pillars, concluding with a comparative analysis and a synthesis of lessons that can be drawn from their diverse experiences. In addition, it presents tables and graphics drawn from the World Bank's Knowledge Assessment Methodology (KAM) database comprising Asian countries. Finally, it identifies some country-specific and regional initiatives that can be undertaken to help developing countries in the region to move toward a KBE.

"I define knowledge as a capacity to act." – Karl Erik Sveiby, SKA (Sveiby Knowledge Associates)

Knowledge is "justified belief that increases an entity's capacity for effective action." – Ikujiro Nonaka, Xerox University of California (Berkeley)

"Knowledge is information that changes something or somebody—either by becoming grounds for action, or by making an individual (or an institution) capable of different or more effective action." – Peter F. Drucker, regarded by business and the academe as the founding father of management study

C. New Paradigms for Managers and Policy Makers

12. To understand and manage the KBE requires some changes in the way the economy and development in general is viewed. Shifts in mental models are needed.[5]

1. Distinction between Knowledge and Information

13. Among practitioners of knowledge management (KM), the term "knowledge" has come to mean capacity for effective action. It includes information useful for producing results or creating

[5] Talisayon, Serafin. 2006. *99 Paradigm Shifts for Survival in the Knowledge Economy, a Knowledge Management Reader.* Parañaque City: Philippines: Center for Conscious Living Foundation.

value. When value is measured in money units, this definition can be translated from the enterprise level to the national system of accounts.

14. Knowledge can be clearly distinguished from other types of information: knowledge is "know how" or "what works" in a given context while information in general is "know what" or "what is."

15. Knowledge is a means for creating value, whether economic or social. In the commercial sphere, business process is the link between KM and value creation:

Knowledge assets → Business processes → Value creation
KM: *How to do it well*
Value proposition: *What is the right thing to do*

16. The procedure in actual KM practice is to work backwards. The starting point is the formal or accepted documentation of core business processes, which can be assumed as reflecting corporate goals and strategies. Working backwards, a knowledge audit provides the basis for determining the most cost-effective KM interventions. In short, the business process is the means for aligning KM to business goals.[6]

2. Recognizing and Managing Intangibles

17. The traditional accounting framework—which is based on past transactions—is basically unable to account for market value of listed corporations—which is based on anticipated future earnings. There is a growing opinion that more comprehensive accounting methods need to be developed to recognize and measure intangible assets.[7]

18. A broader perspective to recognize and measure other forms of assets is needed. The Balanced Scorecard method is an attempt to track what traditional financial statements fail to see. The United States (US) Securities and Exchange Commission has experimented in similar "colorized" reporting of intangible assets to complement financial (or "black and white") reporting.[8]

19. In the Philippines, for example, the national system of accounts has not yet expanded the monitoring and measurement of domestic capital formation to include intangible assets. The nearly $11

''One of the major problems with today's accounting systems is that they are still based on transactions, such as sales. In the current, knowledge-based economy much of the value creation or destruction precedes, sometimes by years, the occurrence of transactions. The successful development of a drug creates considerable value, but actual transactions, such as sales, may take years to materialize. Until then, the accounting system does not register any value created in contrast to the investments made into R&D, which are fully expensed. This difference—between how the accounting system is handling value created and is handling investments into value creation—is the major reason for the growing disconnect between market values and financial information." – Lev Baruch, Professor Accounting and Finance, New York State University

[6] More explanation can be obtained from: Talisayon, Serafin D. 2005. *What is Knowledge Management*. Parañaque City, Philippines: Center for Conscious Living Foundation.

[7] See, for example, Baruch Lev. 2001. *Intangibles: management, measurement and reporting*. Washington, DC: Brookings Institute Press.

[8] Securities and Exchange Commission (SEC) Commissioner Steven M.H. Wallman. 1996. *The Future of Accounting and Financial Reporting, Part II: The Colorized Approach*. Remarks before the American Institute of Certified Public Accountants.

billion annual receipts from overseas Filipino workers is equivalent to more than 9 trillion pesos of net present value of (intangible) human capital—which exceeds cumulative gross domestic (tangible) capital. The Philippine government has developed a satellite accounting system to track environmental and natural capital, but not yet intellectual capital.

3. Stakeholder Capital in a Networked Economy and Society

20. At the individual and organizational levels, the factors that facilitate effective action include tangible assets and three categories of intangible assets or intellectual capital[9] that KM practitioners now recognize:

(i) Tangible assets: equipment, technology, properties, cash, and deposits.
(ii) Intangible assets:
   a. Human capital: skills and work attitudes;
   b. Structural capital (also called "internal capital" or "process capital"): information and other support systems, work processes; and
   c. Stakeholder capital (also called "external capital" or "customer capital"): networks of relationships with customers, suppliers, partners and allies; and local communities.

21. The last category may account for most of the market value of a network-based enterprise. The potential value of a network of *n* members is proportional to n^2 (Metcalf's Law[10]); the marginal benefit of a new joiner increases with *n*, which explains the explosive growth of the Internet.

A dramatic example of the value of networks is ICQ (which stands for "I seek you")—an early form of instant messaging over the Internet—created by five Israeli programmer-entrepreneurs. It attracted over 12 million users after 18 months, when it was bought by America Online for $287 million plus $120 million contingent on future earnings.

22. Like its counterpart in sociology, "social capital,"[11] stakeholder capital in intellectual capital accounting is based on trust, reputation, and what accountants refer to when they say that intangible assets represent "goodwill." As global and national economies and societies become increasingly networked, value creation via networks and the "social trust" underlying such processes would become increasingly important for global competitiveness.[12] Then, government's role would become more essential for creating favorable conditions for sustainable growth. Among the policy recommendations of the Organisation for Economic Co-operation and Development (OECD) during the Second OECD Conference of

---

[9] See, for example, the following sources: (i) Sveiby, Karl Erik. 1997. *The New Organizational Wealth, Managing and Measuring Knowledge-Based Assets*. San Francisco: Berrett-Koehler Publishers; (ii) Stewart, Thomas A. 1997. *Intellectual Capital, the New Wealth of Organizations*. Currency; or (iii) Kiernan, Matthew J. 1995. *Get Innovative or Get Dead, Building Competitive Companies for the 21st Century*. Darby, Pennsylvania: Diane Publishing Co.

[10] Prof. Robert Metcalf, co-inventor of the Ethernet, posited that the value of a network of *n* members is proportional to the total number of possible dyadic connections among them, which is equal to *½ n(n-1)*. Available: http://en.wikipedia.org/wiki/Robert_Metcalfe

[11] Bourdieu defines social capital as "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition." See Bourdieu, Pierre. 1986. The Forms of Capital. In *Handbook of Theory and Research for the Sociology of Education*, edited by John G. Richardson. New York: Greenwood Press.
According to Putnam, social capital "refers to the collective value of all 'social networks' and the inclinations that arise from these networks to do things for each other." See Putnam, Robert. 2000. *Bowling Alone, the Collapse and Revival of American Community*. New York: Simon & Schuster.

[12] Fukuyama of Rand Corporation argued that globally competitive and productive societies tend to be those with high levels of social trust and cohesiveness. Francis Fukuyama.1996. *Trust, The Social Virtues and the Creation of Prosperity*. New York: Free Press.

Ministers Responsible for Small and Medium-Sized Enterprises (SMEs) is the building by governments of a "trust infrastructure."[13]

4. Value-Driven Development

23. Many global changes that have taken place since the early 1970s are driven by technology. The invention of the microprocessor, Internet, and optical communications has radically changed the landscape of business, government, and social life. The sequence of ICT-driven development:

ICT hardware/infrastructure → Knowledge content/functionalities → Value creation

is the reverse of what should ideally be the case. An indicator of this reversed sequence is the observation that governments start with ICT strategies or road maps and establish ICT programs or ministries/departments, and follow these up later with broader knowledge-based strategies. Perhaps, part of the problem is the focus of policy attention on ICT and appreciation of knowledge as clearly distinguished from information coming only later.

24. At the firm level, KM starts from the firm's value proposition and looks at the business processes that create value for the firm and its customers. At the national level, policy and planning starting with national goals and values, such as sustainable development and poverty alleviation, can help reverse the technology-driven development process.

5. Attention to Tacit Knowledge

25. Tacit knowledge is undocumented knowledge. It is embodied in people (human capital), or embedded in informal work processes (structural capital), or earned through working relationships outside (stakeholder capital). Tacit knowledge is more important than explicit knowledge in documents and electronic repositories for three reasons: (i) tacit knowledge accounts for an estimated 75–95% of total organizational knowledge,[14] (ii) the highest form of knowledge—expertise and mastery—is mostly tacit, and (iii) attention to tacit knowledge is important in facilitating the earliest stages of innovation.

26. Yet what gets managed more through ICT is a fraction of the more visible or explicit 5–25% of total organizational knowledge. An employee submits only about 5% of his personal intellectual capital to his company's knowledge repository.[15] ICT can handle only encoded or explicit knowledge, and a small part of tacit knowledge processes such as through e-groups, video conferencing, and voice recognition. ICT, thus, tends to distort policy and decision makers' attention away from the greater fraction of what creates value for the organization, and ultimately for the economy.

27. Perhaps the lack of appreciation of tacit knowledge, which may stem from the lack of a

---

[13] Organisation for Economic Co-operation and Development (OECD). 2004. *ICT, e-Business and SMEs*. France. Available: www.epol-net.org/pport/pdf/696370954.pdf

[14] Kothuri, Smita. *Knowledge in Organizations, Definition, Creation and Harvesting*. Available: www.gse.harvard.edu/~t656_web/Spring_2002_students/kothuri_smita_knowledge_in_orgs.htm. John Seely Brown, coauthor of the book *Social Life of Information*, estimates that "a professional practice—librarian, doctor, physicist—probably consists of 90 percent tacit knowledge and 10 percent explicit knowledge." Available: www.sla.org/content/Shop/Information/infoonline/2000/Jun00/seely.cfm

[15] Hastings, David, Director of Solutions Management, Computer Associates: Building Tomorrow's Corporate Portals (PowerPoint presentation). Available: www.infotoday.com/KMWorld2000/presentations/hastings.ppt

mental model of tacit knowledge and knowledge itself, is another reason some managers and policy makers tend to jump into ICT solutions instead of starting with what economic or social value they wish to create.

D. Models Toward a Knowledge-Based Economy and Society

28. National economies, at whatever stage or type of economic development they are now in, are to a greater or lesser extent using knowledge for development. It is, therefore, inappropriate to speak of being or not being a KBE. It is more accurate to say that Asian economies are all becoming more knowledge-based.

29. Asian governments envision and plan for a mix of KBE and knowledge-based society. It is apparent from official plans and policy statements that economic growth objectives are often mixed with social development objectives. The terms "knowledge-based economy" and "knowledge-based society" both occur in Asian development discourse.

- Thailand's IT2010 speaks of "Knowledge-Based Society and Economy (KBE/KBS)" whereby "the development is therefore not on focusing on 'technology' per se, but rather, on the good use of ICT that would drive overall national economic and social development."[16]
- A basic direction spelled out in e-Korea Vision 2006 is "…focus on qualitative accomplishments… throughout society rather than quantitative expansion of the Internet."[17]
- e-Japan strategy is aimed at creating a "knowledge-emergent society."[18]

Knowledge travels around the world fairly quickly, as opposed to capital. All countries have access to the same pool of knowledge, and nations differ mainly in the degree to which they take advantage of this free public good by investing in physical plan and human capability. – *Knowledge and the Wealth of the Nations*. David Walsh, 2006. Citing Greg Mankiw paper on the Growth of Nations. 1995.

30. Formulations and definitions of KBE vary. The appropriate KBE model will differ from one country to another. It is, therefore, more accurate to refer to KBE models or a KBE model than to talk about the KBE model.

31. The World Bank proposed a widely used KBE model that identifies the four pillars of the KBE:

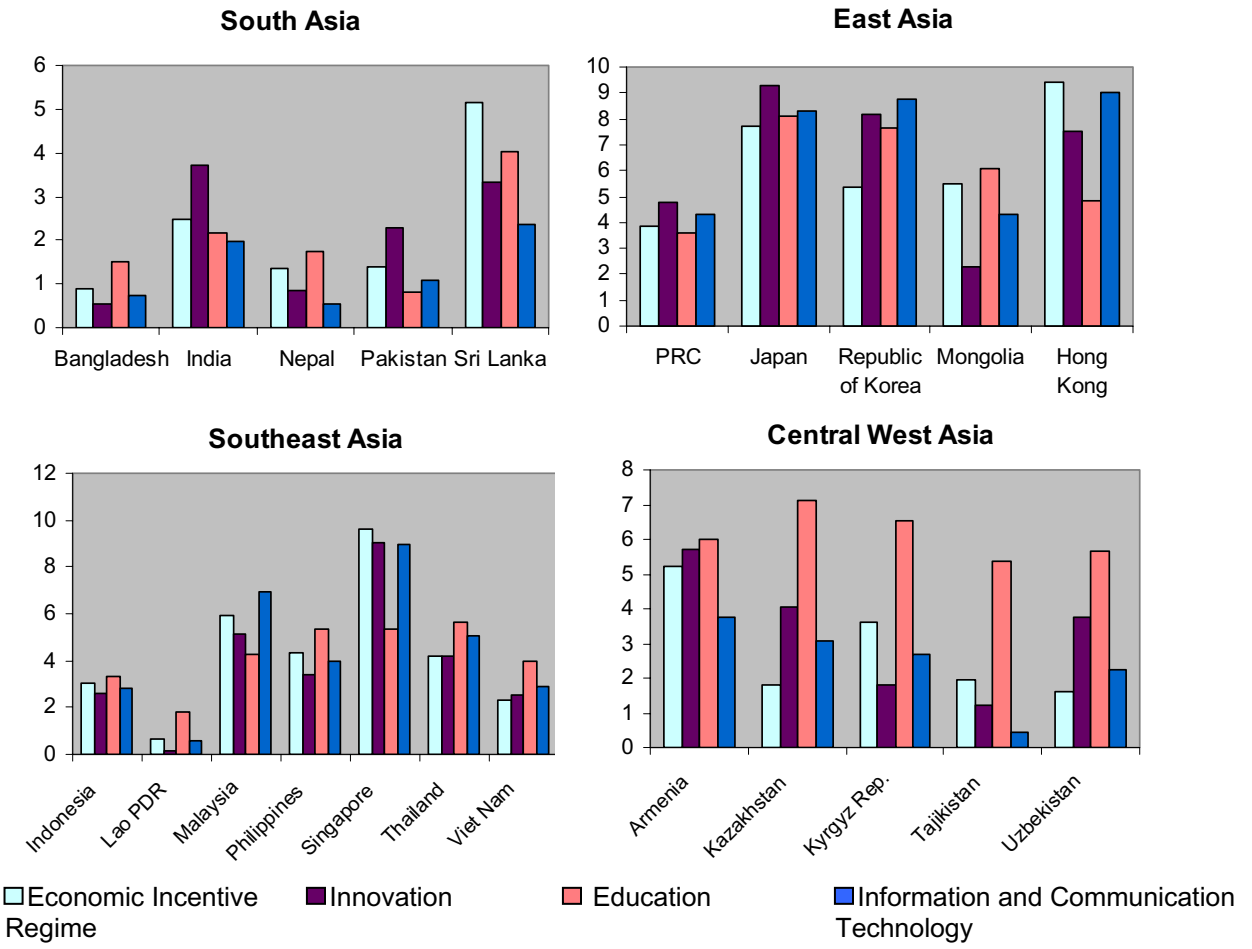
(i) Education for a skilled workforce;
(ii) Science and technology, and innovation;
(iii) ICT infrastructure; and
(iv) Policy and regulatory environment.

32. The first three pillars are the factors that have been found to significantly influence national factor productivities.[19] Accordingly, the World Bank had developed the KAM consisting

[16] Thuvasethakul, Chadamas, and Thaweesak Koanantakool. 2002. National ICT Policy in Thailand. Presented at Africa–Asia Workshop. Malaysia.
[17] e-Korea Vision 2006. Available: http://unpan1.un.org/intradoc/groups/public/documents/APCITY/UNPAN008973.pdf
[18] IT Strategy Headquarters. 2001. *e-Japan Strategy*. Available: www.kantei.go.jp/foreign/it/network/0122full_e.html
[19] Chen, Derek H.C., and Carl J. Dahlman. 2004. Knowledge and Development, a Cross-Section Approach. *World Bank Policy Research Working Paper* 3366. Washington, DC. August.

of indicators along each of the four pillars.[20] Because most of the national indicators selected have long been measured by United Nations agencies, KAM allows for longitudinal and cross-sectional comparisons of national economies.

Figure 1: Knowledge-Based Economy Indicators for the Asian Region



PRC = People's Republic of China; Lao PDR = Lao People's Democratic Republic; Kyrgyz Rep = Kyrgyz Republic.
Source: World Bank, Knowledge Assessment Methodology. Available: web.worldbank.org/WBSITE/EXTERNAL/WBI/WBIPROGRAMS/KFDLP/EXTUNIKAM/0,,menuPK:1414738~pagePK:64168427~piPK:64168435~theSitePK:1414721,00.html

33. The experience of Finland in developing itself as a KBE in a very short time provides some insights on what constitute an effective KBE model.[21] Topping the charts in terms of the World Economic Forum's competitiveness index, OECD's Program for International Student Assessment, and the Knowledge Economy Index of the World Bank, Finland has managed to maintain a good balance among the different elements pertinent to the knowledge economy—

[20] Dahlman, Carl. 2002. *Knowledge for Development, Assessment Framework and Benchmarking*. Singapore. See also Chen, Derek H.C., and Carl J. Dahlman. 2005. *The Knowledge Economy, the KAM Methodology and World Bank Operations.* Washington, DC: World Bank. Available: http://web.worldbank.org/WBSITE/EXTERNAL/WBI/WBIPROGRAMS/KFDLP/EXTUNIKAM/0,,menuPK:1414738~pagePK:64168427~piPK:64168435~theSitePK:1414721,00.html

[21] Dahlman, Carl, Jorma Routti, and Pekka Yla-Antilla. 2005. *Finland as a Knowledge Economy: Elements of Success and Lessons Learned (Overview)*. Washington, DC: World Bank.

economic incentives, education, innovation, and IT infrastructure. When Finland took over the presidency of the European Union (EU) in July 2006, Prime Minister Matti Vanhanen delivered a speech in which he emphasized what governments and the EU can do to strengthen their role toward a KBE:

- Sufficient public funding for R&D and wise funding arrangements for starting business;
- Close cooperation and efficient networking among universities, public innovation centers, and firms, small and large;
- Healthy competition and open markets to create pressure for innovation;
- Well-functioning labor markets; and,
- An education system that can respond to changing competence requirements.[22]

34. Finland's economy experienced major restructuring efforts in the 1990s, particularly in R&D investments, exports, and capital markets, while at the same time, banking on its strengths and current endowments to advance to the knowledge age. One notable example is the success by which Finland was able to move from natural resource-based industries to knowledge-based ones. It traced the early origins of its knowledge economy to the "user-producer linkages" between the forest-based industries as among the first users of advanced technology in engineering, electronics, and ICT.

35. Finland's experience showed how the elements of a KBE must be examined from the perspective of interrelatedness. Its innovation system, for instance, has been successful in ensuring that the educational capacity of its workforce and the investments in R&D are translated into industrial and export potentials in sectors involved in high technology. Their experience also highlights the importance of flexibility of an economy to changing conditions, the critical role of the education system, and the importance of using indigenous knowledge and of developing new appropriate ones.

1. Factoring in Sustainable Development

36. Human rights, sustainable development, and poverty alleviation are basic consensual values of the international community, as embodied in the United Nations' decisions such as the Declaration of Human Rights, Agenda 21, and the Millennium Development Goals, respectively.

37. Sustainable development is a development paradigm officially adopted by 118 governments in the Rio Summit of 1992 and enshrined in Agenda 21. Basically, it asserts the equal importance of three value domains: economy, society, and natural environment. Growths in economic capital, social capital, and natural capital are equally important but should not be pursued at the expense of one another. Knowledge—as a means for creating value—should be designed to support all three value domains. The result is a development model or option that is broader than KBE and, which is but a formalization of the mix of economic and social objectives that many Asian governments are already pursuing.

[22] Speech Prime Minister Matti Vanhanen. 30 August 2006. Available: www.vnk.fi/ajankohtaista/puheet/puhe/en.jsp?toid=5307&c=0&moid=5308&oid=166093

Table 1: A Model of Knowledge-Based Development (KBD)

	Economic (KBE)	Social	Natural
Education (development of human capital)	***Education for a skilled workforce***	Education for total human development	Education for sustainable development
Innovation (Development of structural capital)	*Systems, processes, and* ***technological innovations***	New institutions and protocols for peace, equity, and human rights	Environmental technologies, e.g., renewable energy technologies
Building Networks (Development of stakeholder capital)	*Financial and physical networks, e.g.,* ***ICT infrastructure***	Social networks, social trust, cultural integrity	Agreements to protect and sustain planetary life support systems

ICT = information and communication technology.
Source: Talisayon, Serafin. 2006.

38. Building on the World Bank's formulation of the four pillars of a KBE, which is focused on the economic dimension (italicized entries in Table 1), the resulting alternative framework combines the two globally emergent development paradigms: sustainable development and knowledge management (KM). If the KBE framework is broadened to encompass also planning for a knowledge-based society and a knowledge-assisted caring for the environment, then the resulting broader framework can be called Knowledge-Based Development (KBD).

39. The World Bank's four pillars of a KBE and the corresponding scope of KAM fit precisely the three categories of intellectual capital applied to the economic domain (see "Economic [KBE]" column in Table 1):

- Education for a skilled workforce is development of human capital.
- National innovation systems is development of structural capital.
- ICT infrastructure is development of the technical aspects of stakeholder capital, while policy and regulatory environment is about the nontechnical aspects of stakeholder capital.

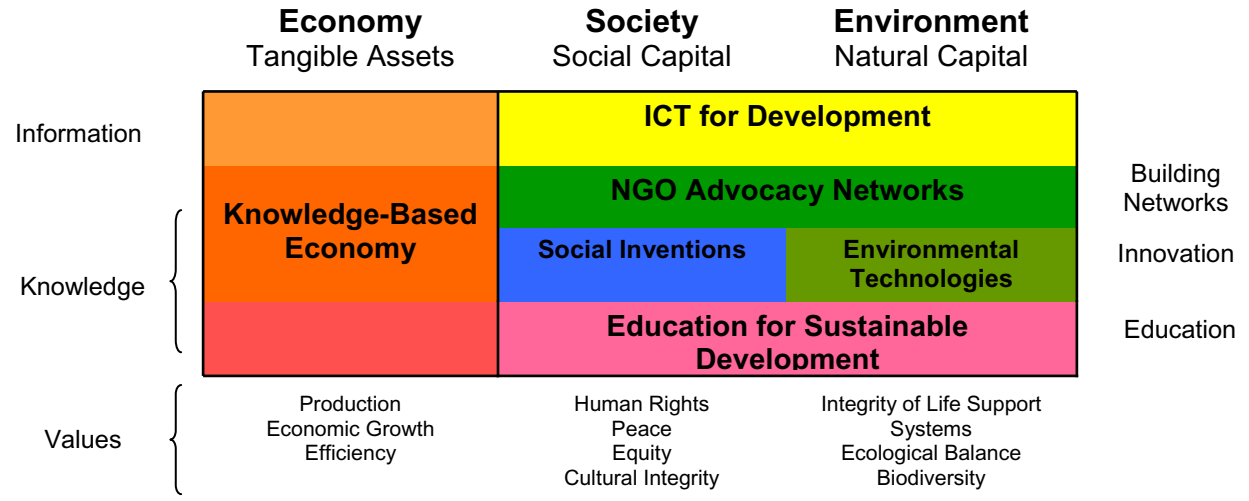
40. Similarly, the OECD policy framework for KBE embraces three policy areas: ICT including communication infrastructure and e-business; science, technology, and innovation; and skills, education, and knowledge-based employment.[23]

41. Accordingly, if the World Bank's KAM is expanded to include indicators along the six additional elements under the social development and environmental management criteria, the result would be an assessment methodology for KBD.

42. Following the KBD perspective, the ICT infrastructure should be expanded to "infrastructure for a networked society" where "infrastructure" and "network" are understood both in their physical–technical and social institutional dimensions. Similarly, the concept of technological innovation should be broadened to encompass social inventions [24] —new institutions, programs, legislation, and protocols—to pursue socially desirable goals such as peace and human rights. Corresponding development of simple but more comprehensive indicators could be part of ADB's agenda toward planning for KBD.

[23] Vickery, Graham. 2003. *Policy Frameworks for the Knowledge-Based Economy: ICTS, Innovation and Human Resources.* Vienna: Austrian Council International Workshop. 10 July.
[24] Stuart Conger first introduced this concept. Available: www.innovation.cc/discussion-papers/stuije.htm

Figure 2: Knowledge-Based Development



Source: Talisayon, Serafin. 2006.

43. In brief, all three value domains of sustainable development should be pursued together, and through the development and deployment of three categories of knowledge assets: human capital through education, structural capital through innovation, and stakeholder capital through building of networks.

44. How these value domains are pursued is expected to vary from country to country. There will be as many KBD models and KBE-KBD mixes as there are countries.

II. THE FOUR PILLARS OF A KNOWLEDGE-BASED ECONOMY

A. Education and the Skilled Workforce

45. Human capital is the basis of the other two forms of intellectual capital. Continuous improvement across societal and economic sectors increasingly relies on the generation and use of creative ideas and knowledge. Analytical work on long-term economic growth shows that in the 20th century, human capital has grown most rapidly among the factors of production. No signs indicate that the rate of return to investment in education and training has declined.[25]

46. The knowledge economy is transforming labor market demands throughout the world.[26] This is the case both for existing and established industries that require more creative and innovative workers as they attempt to move up the value chain, as well as emerging ICT-dependent industries that demand more high-skilled and adaptable workers. There is "upskilling" both in the manufacturing and services sectors. In all scenarios, the demand for lower-skilled workers is declining.[27]

---

[25] Abramowitz, M. 1989. *Thinking about Growth*. Cambridge: Cambridge University Press. Quoted in OECD. 1996 *The Knowledge-Based Economy*. Paris.
[26] Carnoy, M. 1998. The Changing World of Work in the Information Age. *New Political Economy* 3(1):123–128.
[27] OECD. 2001. *OECD Science, Technology, and Industry Scoreboard: Towards a Knowledge-Based Economy*. Paris.

47. While the need to invest in education is widely accepted, it has to be recognized that such investments need to be accompanied by congruent technology policies to ensure that increasing returns to scale are achieved.[28] The link between education and technology needs to be strengthened through appropriate technologies and responsive policies, and the development of more innovative and research-intensive educational institutions.

1. Skills Required in a Knowledge-Based Economy

48. In the knowledge age, change is so rapid that workers constantly need to develop new skills and competencies.[29] With the basis of work moving from routine tasks to knowledge creation, Yim-Teo argues that the workforce must therefore possess competencies including creativeness, responsiveness, productiveness, and the ability to adapt to a fast-changing environment.[30] Greater productivity among a fewer number of workers is needed, and this can be achieved as workers develop greater initiative and the ability to work in teams, and as they hone their skills in problem solving and critical thinking.[31]

49. The need for IT skills across industries is growing. But apart from IT skills, workers must know how and where to look for, process, and exploit information; think critically; solve problems with minimum instruction; learn and upgrade constantly; communicate effectively; and work individually and in teams. Rychen and Salganik[32] and the OECD[33] attempted to summarize these new competencies and sets of knowledge and arrived at three categories—acting autonomously, using tools interactively, and functioning in socially heterogeneous groups. All these can be further summarized into one core competency: learning how to learn.

50. This conclusion is consistent with the recommendations of the International Commission on Education for the Twenty-First Century (also known as the Delor Commission of the United Nations Educational, Scientific and Cultural Organization [UNESCO]), that the critical skills for the 21st century are: (i) learning to do, (ii) learning to be, (iii) learning to relate, and (iv) learning to learn.[34] In 1996, the Literacy Coordinating Council of the Philippine government adopted an expanded definition of functional literacy to embrace the skills needed not only for the knowledge economy but also for a world that is shrinking and still beset with serious issues in peace, human rights, and equity (see box: An Expanded Definition of Functional Literacy).

---

[28] ADB. 2006. Asian Institute of Management: Enhancing the Complementarities of Education and Technology: Key to Transitioning to a Knowledge-Based Economy, Working Paper (Unpublished). Manila: ADB.

[29] World Bank. 2003. *Lifelong Learning in the Global Knowledge Economy: Challenges for Developing Countries, A World Bank Report*. Washington, DC.

[30] T. Yim-Teo. 2004. Reforming Curriculum for a Knowledge Economy: The Case of Technical Education in Singapore. Presented at the Education That Works: The NCIIA 8th Annual Meeting, 18–20 March in Nanyang Technological University, Singapore.

[31] The Ohio Department of Education. 1990. Ohio's future at work, Action plan for accelerating the modernization of vocational education in Ohio.
Also: Secretary's Commission on Achieving Necessary Skills (SCANS): What work requires of schools, SCANS 2000. US Department of Labor. Washington, DC. 1991.

[32] Rychen, D.S., and L. Salganik, eds. 2001. *Defining and Selecting Key Competencies*. Kirkland, WA: Hogrefe and Huber.

[33] OECD. 2002. *Definition and Selection of Competencies, Theoretical and Conceptual Foundations (DeSeCo)*: Strategy Paper on Key Competencies, A Frame of Reference for a Coherent Assessment and Research Program. DEELSA/ED/CERI/CD (2002)9. Paris.

[34] International Commission on Education for the Twenty-First Century. 1996. *Learning, the Treasure Within*. Report to the United Nations Education, Scientific and Cultural Organization (UNESCO). Paris: UNESCO.

An Expanded Definition of Functional Literacy

1. **Communication Skills**
   Ability to clearly express one's ideas and feelings orally and nonverbally; ability to listen; ability to read, comprehend, and respond to ideas presented; ability to write and clearly express one's ideas and feelings; ability to access, process, and utilize available basic and multimedia information
2. **Critical Thinking and Problem Solving**
   Numeracy skills, open to change, aware of options, ability to make critical and informed decisions, innovativeness and creativity, scientific thinking, future orientation
3. **Sustainable Use of Resources/Productivity**
   Ability to earn a living, sustainable use of resources (including time) and appropriate technology, entrepreneurship, productivity
4. **Development of Self and a Sense of Community**
   Self-development: self-awareness, self-discipline, sense of responsibility, self-worth, self-realization, *may paninindigan* (principled*), pagbabagong-loob* (capability to change), *pakikipagkapwa*/*pakikilahok*/*pakikilahok*/*kapatiran* (ability to relate/ brotherhood);
   A sense of personal and national identity: *makatao* (humane), *makabayan* (nationalistic), *makakalikasan* (love of nature), *maka-Diyos* (God-centered); knowledge of one's history, pride in one's culture and respect for those of others; recognition and practice of civil and political rights
5. **Expanding One's World Vision**
   Knowledge, acceptance, respect, and appreciation of diversity; peace; nonviolent resolution of conflicts; global awareness, interdependence and solidarity

Source: Literacy Coordinating Council, Department of Education, Philippines.

2. New Teaching and Learning Strategies

51. While technical and interpersonal skills, which are currently being addressed by educational institutions, are still requirements in this new economy, a new set of crucial skills has emerged. Termed as "methodological skills," these skills include "the ability to learn on one's own, to pursue lifelong learning, and to cope with risk and change." [35] These methodological skills cannot be acquired under the traditional educational system where the teacher acts as the sole source of knowledge, imparting facts to students who imbibe it for purposes of passing courses and earning their degrees. New teaching strategies where the teacher serves as facilitators of learning need to be developed to nurture "learning how to learn" among students (Table 2).

Table 2: Differences Between Traditional and New Teaching Strategies and Workplaces

Traditional Arrangements		New Arrangements	
Teaching Strategy	**Workplace**	**Teaching Strategy**	**Workplace**
Teachers as experts convey knowledge to passive learners	Passive order-taking in a hierarchical work organization; heavy supervision to control workers	Under teacher guidance, students assume responsibility for learning, in the process developing knowing-how-to-learn skills	Workers are expected to take responsibility for identifying and solving problems and for adapting to change by learning

[35] World Bank. *Lifelong Learning in the Global Knowledge Economy*. Available: www1.worldbank.org/education/lifelong_learning/skills_competences.asp

Traditional Arrangements		New Arrangements	
Teaching Strategy	**Workplace**	**Teaching Strategy**	**Workplace**
Emphasis on facts and on getting the right answers	Emphasis on limited responses to limited problems and on getting a task done	Focus on alternative ways to frame issues and problems	Workers deal with nonroutine problems that have to be analyzed and solved
What is to be learned is stripped of meaningful context	Focus on the specific task independent of organizational context or business strategy	Ideas, principles, and facts are introduced, used, and understood in meaningful context	Workers are expected to make decisions that require understanding the broader context of their work and their company's priorities

Source: Sue Berryman. 2000. *Hidden Challenges to Education Systems in Transition Economies.* Europe and Central Asia Region, Human Development Sector, World Bank.

52. The workplace is also being transformed into a place for teaching and learning. The workers' receptiveness to training and retraining is very important, given that the restructuring and rapid changes that will be imposed by the new economy are likely to displace untrained and untrainable workers, especially the old, the poor, and the marginalized who lack the qualifications and necessary adaptability. The workplace as a venue for continuous learning has been promoted even by the private sector.

3. Diaspora

"...the major task in society, and especially in the economy...(is) doing something different rather than doing better what is already being done... dynamic dis-equilibrium brought on by the innovating entrepreneur, rather than equilibrium and optimi-zation, is the "norm" of a healthy economy and the central reality for economic theory and economic practice." – Peter F. Drucker, regarded by business and the academe as the founding father of management

53. A critical issue that has emerged in the realm of human resource development is the diaspora or migration of skilled workers. Given the availability of skilled workers in Asia and the high demand in developed countries like the United States and Europe, Asian countries face the issue of retaining the skilled workers they have educated and trained. US firms, for instance, have been mandated by the US Congress in the late 1990s to recruit 600,000 foreigners, a third of them from India. The PRC has lost more than 200,000 international Chinese students since 1978. Probably because of the blossoming of the PRC economy the number of students that went abroad increased to 580,000 as of 2003 while 160,000 graduated students have returned. Increasingly, more students decide to return to the PRC.

54. When skilled workers migrate, the source country loses out because of the decline in their skill endowment and, hence, the potential output of the country's labor force. The source country in effect is subsidizing the receiving country in terms of higher output and foregone expenditures in schooling. However, this argument on "brain drain" has encountered debate among economists who argue that the return of these skilled individuals constitute a "brain gain," which raises the skill level of the home country.[36]

55. By the turn of the century, discussion on this issue took on a different light, with the emergence of the transnational mode of thinking which recognizes that global links may be of more value than a country's human capital stock. This thinking argues that a professional may in fact contribute more to the home country by residing overseas than by returning home

[36] Wescott, C., and J. Brinkerhoff, eds. 2006. *Converting Migration Drains into Gains: Harnessing the Resources of Overseas Professionals*. Manila: ADB.

permanently. This is possible through what has been described as "diaspora networks" or "expatriate networks" which are described as "the locus of concerted action by expatriates to promote their collective interests or to help them become engaged in their home countries."[37] Equipped with ICT tools, members of the network act as network builders themselves who, aware of the issues and concerns back home, use the resources of their host countries to help solve home country problems.[38] Empirical evidence on this includes 43 diaspora networks identified by Brown as performing this "gatekeeping" function through the use of the Internet.[39] In short, using the language of KM, the loss of human capital may be offset to some extent by the gain in stakeholder capital.

56. The case of India's software industry is one compelling example where Indian expatriates played a critical role in growing the industry, facilitating the creation of 700,000 software jobs and the export of over $17 billion per annum. However, not all countries are able to benefit from diaspora networks. Wescott (2006) cites the Philippines as a case in point[40] and attributes that the country's inability to take advantage of diaspora networks to the lack of a government policy on harnessing the potentials of skilled labor migration.[41]

B. National Innovation Systems

57. A national innovation system (NIS) is "a subsystem of the national economy in which various organizations and institutions interact and influence each other in the carrying out of innovative activity."[42] The NIS provides a more comprehensive view of a country's innovation system, including embedded learning processes, incentive mechanisms, and interactions and relationships among the different actors involved in the innovation process.[43]

> The most recent discovery, the one that has not been obvious all along, is that, in a rapidly converging global economy, capital will by and large take care of itself (with an occasional nudge from central banks), but human and technological resources require a degree of active management by the state. It seems unlikely that government science managers and education secretaries will ever be thought of as ranking on a par with central bankers or finance ministers or even trade negotiators, but technology, training and education policy will eventually come to be seen in countries all around the world a necessary and legitimate responsibility of government, as important as monetary and fiscal policy, and even harder to execute as well. – David Warsh. 2006. *Knowledge and the Wealth of Nations*.

58. The NIS concept recognizes the fact that innovation and improvements in technical capacity are the result of a complex set of relationships among actors creating, acquiring, disseminating, and applying various kinds of knowledge. The main actors include private

[37] Kuznetsov, Y., and C. Sabel. 2005. *Global Mobility of Talent from a Perspective of New Industrial Policy: Open Migration Chains and Diaspora Networks*. Paper presented at the United Nations (UN) Economic Commission for Latin America and the Caribbean (ECLAC)-UN University workshop on international mobility of talent on 26–27 April in Santiago, Chile.

[38] Barré, R., V. Hernandez, J.-B. Meyer, and D. Vinck, eds. 2004. *Diasporas scientifiques, Expertise collégiale: Institut de Recherche sur le Développement*. Paris, France: Ministry of External Affairs.

[39] Brown, M. 2002. *Intellectual Diaspora Networks: their viability as a response to highly skilled emigration in Fibbi.* R and Meyer, J.B., eds. 2002. *Introduction: le lien plus que l'essence», Diasporas, développements et mondialisations*. Paris: Institut de Recherche pour le Développement (IRD), Editions de l'Aube.

[40] Wescott, C. 2005. *Promoting Knowledge Exchange through Diasporas*. Prepared for G-20 Workshop on Demographic Challenges and Migration on 27–28 August in Sydney, Australia.

[41] Opiniano, J. 2004. *Our Future Beside the Exodus: Migration and Development Issues in the Philippines*. Pasig City, Philippines: Friedric Ebert Stiftung.

[42] Balzat, M. 2002. *The Theoretical Basis and the Empirical Treatment of National Innovation Systems.* Augsburg, Germany: University of Augsburg, Institute for Economics.

[43] Martinez-Cisneros, B. 2004. *National Innovation Systems: Lessons from East Asia to Latin America*, Case studies of Costa Rica and Chile. Georgia, US**:** School of Public Policy, Georgia Institute of Technology.

enterprises, universities and public research institutes, intermediaries such as technological zones or parks, and relevant financial institutions. The basic premise of innovation systems is that innovation cannot happen if these actors are not linked and, therefore, do not interact with each other.[44] Through these innovation systems, structural capital in the form of systems, processes, and new technologies is further developed.

59. Liu and White (2000) identified five fundamental activities of innovation systems, noting that these extend beyond a simple R&D system as it considers both inputs and outputs of research:[45]

(i) Research which may include basic, developmental, or engineering;
(ii) Implementation such as in the case of actual manufacturing or production;
(iii) End-use which includes identifying the customers of the product or process outputs;
(iv) Linkage or the process of bringing together complementary knowledge; and
(v) Education or necessary learning processes.

1. The Role of Governments

60. Governments play a crucial role in innovation since they provide the key to encouraging, coordinating, and linking all innovation efforts by different actors in an economy. Innovation requires a favorable regulatory climate that encourages interactions among the different NIS players. The ideal scenario is that these interactions and linkages happen not only internally among players in a particular country, but also extend globally to outside business environments. It has been noted that technological change can take place through inter-country transactions such as direct investments, trade, and technology transfer or licensing that allow for the tapping of global knowledge.[46]

2. Networking for Research and Development

61. A strategic area for regional cooperation is networking for R&D or innovation, which combines knowledge creation with the multiplicative and synergistic power of networks. Networking for R&D is not new; professional and scientific associations whose members meet face-to-face in annual conventions are traditional forms of networking for R&D. What is new is that advances in ICT are enabling greater, more frequent, and effective people-to-people interaction for R&D, as well as high-bandwidth links for information transfer and shared computation. The converse is also true, demanding requirements by universities and research institutions for networked R&D is pushing the innovation envelope of ICT—which was how the Advanced Research and Projects Agency Network (ARPANet) started from whence the Internet was born.[47]

62. In Asia, early networking for R&D was both government- and private sector-led. For example, the Southeast Asian Regional Center for Graduate Study and Research in Agriculture was set up by the Southeast Asian Ministers of Education Organization in 1966. In 1980, seven

[44] See footnotes 42 and 43. See also Johnson, B., C. Edquist, and B. Lundvall. 2003. *Economic Development and the National System of Innovation Approach*. Presented in the First Globelics Conference in Rio de Janeiro, Brazil.
[45] Liu, Xieling, and Steven White. 2000. *Comparing Innovation Systems: A Framework and Application to China's Transitional Context*. Mimeo. Beijing and Hong Kong, China.
[46] Dahlman, C., and A. Utz. 2005. *India and the Knowledge Economy. Leveraging Strengths and Opportunities. WBI Development Studies*, Washington, DC: World Bank.
[47] Hobbe's Internet Timeline v8.1. Available: www.zakon.org/robert/internet/timeline/

high-tech companies from different technical specializations set up the Tsukuba Research Consortium, located in Tsukuba Science City that the Japanese government developed in 1964. In 2001, the Greater Mekong Subregion Academic and Research Network, an alliance of eight top ranking educational institutions, was established.

63. R&D networking can be for commercial purposes. Together with globalization of production, globalization of R&D, such as outsourcing of software development to companies in India, also takes place. R&D networking can also be for social development purposes and ICT support can be simple web-based functionalities for collaborative work, information and knowledge exchange, discussion lists/forums, and linked knowledge repositories among nongovernment organizations (NGOs).

64. Networking can range from national research and education networks employing high-bandwidth connections, to knowledge networks funded by international development financing agencies, to simpler web-based NGO research networks.

65. Many countries in Europe and in Asia have their own national research and education networks that are in turn linked up via regional networks. In Asia, two of these major networks are:

- Asia-Pacific Advanced Network (APAN) (www.apan.net), an international, nonprofit consortium of 15 countries established on 3 June 1997 designed to be a high-performance network for R&D on advanced or next generation applications and services. It provides an advanced networking environment for the research and education community in the Asia and Pacific region and promotes global collaboration. Among its activities are exchanging technical information, arranging and organizing education and training workshops, technology and engineering collaboration, and virtual user community development.
- Trans-Eurasia Information Network (www.tein2.net) creates the first large-scale research and education network for the Asia and Pacific region, linking 10 countries (Australia, PRC, Indonesia, Japan, Republic of Korea, Malaysia, Philippines, Singapore, Thailand, and Viet Nam) at speeds of up to 622 megabytes per second (Mbps). It connects regional researchers with their counterparts in Europe via GEANT2, the world's most advanced international research and education network, providing the Asia and Pacific countries with gateway for global research collaboration.

66. A variety of networks also support R&D, science and technology, and innovation in Asia. While these networks have different thrusts and specializations, regional or inter-country cooperation and collaboration for advancing science and technology is a common objective. Among these networks are:

- Asian and Pacific Centre for Transfer of Technology (APCTT) (www.technology4sme.com) is a regional institution of the UN Economic and Social Commission for Asia and the Pacific (UNESCAP) established in 1977 in Bangalore, India aimed at facilitating technology transfer in the Asia and Pacific region. The activities of APCTT are directed toward technology capacity building, promotion, and management of innovation as well as subregional and regional networking. In this direction, the center focused on four specific areas of activity which are SME-oriented, IT-powered, environmentally responsible, and gender conscious. Among the new initiatives of APCTT include (i) a web-based market for technology trade

between technology sellers and buyers called Tech-Mart; (ii) a comprehensive web portal called Technology4sme to facilitate technology transfer and business development focusing on SMEs; and (iii) a web-based sector-wise community called Business Circle for business people who wants to explore business opportunities in the Asia and Pacific region.

- Asia-Pacific Gender Equity in Science and Technology (APGEST) (http://jakarta.unesco.or.id/apgest/) is a major component of Asia-Pacific Gender Equity Network (APGEN), an initiative on gender, science, and technology, spearheaded by UNESCO in Jakarta. APGEST aims to promote the adoption of policies and programs that ensure access to cutting-edge science and technology by women living in poverty in the Asia and Pacific region. Among the activities it carries out are: (i) scanning policy and institutional reforms, programs, and projects addressing gender issues in science, engineering, and technology sector; (ii) providing technical assistance to APGEN pilot projects in the areas of research and gender mainstreaming; and (iii) disseminating results and application of lessons learned across the region.
- Asia-Pacific Science and Technology Center (APSTC) (http://apstc.sun.com.sg/) envisions to be a well-established and recognized center specializing in scientific computing. It was officially established in December 2002 when Sun Microsystems, with support from Singapore's Economic Development Board opened its flagship regional research headquarters in Singapore. The center focuses primarily on growing expertise in grid computing and high-performance computing. Its objectives include: (i) working with the scientific community in adopting and developing latest Sun technology, (ii) transferring know-how and exchanging knowledge with academic and research institutions, and (iii) monitoring trends in high performance computing and in specific scientific and engineering communities. APSTC collaborates with universities and research institutes that are mainly in the Asia and Pacific region.
- Science Council of Asia (SCA) (www.scj.go.jp/en/sca/index.html) brings together scientists and scientific organizations from all academic fields to promote cooperation in scientific research among Asian countries to actively address science-related issues such as including population problems, medical care, food, water, energy, and knowledge of and education in the sciences. SCA takes part in science-related activities of the United Nations, the United Nations University, and other international scientific associations. It also promotes joint projects proposed by member countries and supports international scientific conferences on scientific issues, science-related policy, and promotion of science in Asia.
- Science and Technology Policy Asian Network (www.stepan.org/) was established in 1998 as a network of researchers and institutions in the Asia and Pacific region focusing on research and training support for national science and technology (S&T) policy and management programs under the auspices of UNESCO. It provides an umbrella policy-level network to all other UNESCO science networks. It puts its priority on helping other member countries to review their S&T policies and strategic implementation of the nation's innovation vision. It is a vehicle for international policy-level dialogue and assistance in developing S&T policy capacities across the Asia and Pacific region.

C. Building Networks

67. Modern economies are characterized by a complex interplay of competition and collaboration between economic actors. The contribution of competition to economic efficiency and productivity is easier to grasp. But some key determinants of growth in KBEs involve the acquisition of new and emerging technologies. This requires generation and adoption of scientific knowledge and new technologies, the pursuit of innovation, and the development of the necessary human resources. This also requires extensive collaboration and networking with relevant parties across the region and the world.[48] Building networks, whether ICT-enabled and/or sustained by a foundation of social trust built through traditional face-to-face interaction, is one of the major tasks in moving toward a knowledge-based economy and society. ICT infrastructure and social trust are ingredients for developing national stakeholder capital.

68. Many features of the KBE have been shaped and reinforced by fast development and growing use of ICT. ICT provides for efficiently acquiring, capturing, storing, disseminating, and using local and foreign knowledge on a global basis. This is because of the capacity of ICT to support the development of networks and to establish and maintain connections among individuals, groups, and organizations that possess knowledge considered to be of great use and value to others. In fact, the importance of ICT in supporting knowledge-based development (KBD) lies in its capacity for efficient networking, interconnectivity, interdependence, and coordination. Whereas physical infrastructure is critical in the industrial age, information infrastructure is becoming indispensable in the knowledge age.

69. Social and business networks are typically prevalent in Asian countries; they are an advantage in doing business. *Chaebols* in ROK, *keiretsus* in Japan, and *guanxi* networks in Chinese business communities—with their own advantages and disadvantages—had been institutionalized forms of stakeholder capital. *Musyawarah* (consultation) and *mufakat* (consensus) are Malay practices adopted in the Association of Southeast Asian Nations (ASEAN) meetings that can be viewed as serving to build stakeholder capital. Relationship building is important in Asian cultures as they capitalize on relationships for business, personal, or other purposes. The unexpectedly rapid growth of short messaging system or sending of text messages via mobile phones in the Philippines can be attributed to the value that Filipinos place on relationships. Network building in Asia is probably a business and social arena where we would continue to witness how technology and culture could reinforce each other.

1. Benefits of ICT and Networks

70. The ICT revolution has fast-tracked the innovation process; it is increasing the speed and decreasing the cost of developing tools and instruments for both basic and applied research. With this infrastructure, prototyping, product demonstrations, and simulation techniques are made more viable. Electronic networks are also facilitating research work with information ready to be located and accessed regardless of source location and time.

71. In business, networks facilitate borderless transactions accomplished in a spectacularly shortened time span. For instance, global financial transactions can take place in a fraction of a minute given the appropriate ICT. New “de-materialized” knowledge products are finding their way to various markets all over the globe through e-commerce, with online transactions proceeding almost instantaneously. ICT and related tools also enhance the quality of products, production and delivery processes, inventory management, and labor productivity—all these are

[48] ADB. Established in 2006 through a RETA the creation of Regional Knowledge Hubs to enhance networking.

translating into improved global competitiveness both of firms and of their host countries. With increasing connections, trust between global allies and partners are sustained, making cross-border partnerships among players in supply-and-production chains possible.

72. ICT is considered a major contributor to new service-based and knowledge-based industries. ICT in itself is a technology-based business sector that has evolved quite dramatically in the last decade, giving rise to new businesses engaged in systems designing, networking and connectivity, broadband technology provision, microchip production, and providing co-location services, among others. It has likewise served as the major catalyst behind the rise of business process outsourcing and backroom operations, including call center operations, offshore software development, payroll processing services, and transcription services. The business model of outsourcing noncritical business processes became viable as the costs of maintaining cross-country business activities became cheaper and the infrastructure for connecting to internal and external customers became available.

73. Advances in ICT also offer numerous opportunities for innovative learning and education applications. The education sector has benefited much from the use of ICT, allowing even marginalized groups to have access to education through distance education and virtual learning, for example.[49] The need of workers for continuous learning is also being addressed through e-learning methods delivered via company intranets.

74. If properly used, ICT can improve both the internal operations of governments and their interface with the public. This is e-governance. The delivery of public services can be hastened through ICT, as in the case of public education[50] and health services,[51] the provision of information regarding markets, and maintenance of peace and order, among others.

75. The benefits of ICT can be summed up in a statement made by the G-8's Digital Opportunity Task Force (DOT Taskforce): "ICT when wisely applied, offers enormous opportunities to narrow social and economic inequalities and support sustainable local wealth creation, and thus help to achieve the broader development goals that the international community has set." It reports that ICT can provide new and more efficient methods of production, being previously unattainable markets within the reach of local producers, improve the delivery of government services, and increase access to basic social goods and services. ICT is an "enabler of development" as it helps in enhancing rural productivity by allowing solution sharing among communities and providing timely market information especially to farmers. Also, it has the ability to help develop economies make real progress in health and education, as well as to create an informed and empowered citizenry.[52]

2. Toward an Ubiquitous Network Society[53]

76. "Ubiquitous Network Society" is "a society where information can be exchanged anytime, anywhere, instantaneously between people, objects, and systems." This happens as objects

[49] Dahlman, C., and J. Aubert. 2001. *China and the Knowledge Economy: Seizing the 21st Century. WBI Development Studies.* Washington, DC: World Bank.
[50] See footnote 46.
[51] See, for instance, the chapters of S. Haque entitled Bangladesh, and E. Lallana entitled Philippines, in *Digital Review of Asia Pacific.* United Nations Development Programme (UNDP), Canada's International Development Research Centre (IDRC), and Obricom Network of UNESCO Chairs, 2003/2004.
[52] Digital Opportunity Task (DOT) Force. 2001. *Digital Opportunities for All: Meeting the Challenge, A Report of the DOT Force.* 11 May.
[53] The main source of this section is the draft paper entitled Ubiquitous Network Society and the Knowledge Based Economy by the Asian Institute of Technology for ADB in 2006.

with embedded microprocessors—in addition to traditional computers—become connected through an invisible or wireless network. These objects can include merchandise, personnel identification cards, cars, video cameras, home and office furniture and equipment, etc. that can then be accessed or controlled through computers. A typical example of an ubiquitous network application is the "smart home" where all "intelligent" equipment in the house are networked and can automatically operate cooperatively or be centrally controlled.

77. Related to the concept of ubiquitous networking is social computing, which "refer(s) to the interplay between persons' social behaviors and their interactions with computing technologies." [54] Examples of social computing are voicemail, e-mail, online chats, and collaborative applications. The twin concepts of ubiquitous network society and social computing are believed to reinforce and enhance each other, as exchanges in information and social interactions related to specific contexts are encouraged. As new context-sensitive and interactive ICT applications are developed, ICT network infrastructure, interpersonal communication, and social capital would increasingly blend and reinforce each other in an ubiquitous network society.

78. Ubiquitous network societies can benefit a number of sectors including business, health, agriculture, disaster prevention, government, and civil society.

3. Elements Needed in Building ICT

79. An appropriate regulatory framework is one of the most important requirements for encouraging private sector participation in the ICT sector. This is indeed critical since governments that neither have sufficient resources nor expertise to perform this task cannot solely accomplish ICT developments. Governments have, in fact, moved to being promoters and facilitators of ICT use and development, and their current challenge includes determining the appropriate level of liberalization and deregulation, leveling the playing field for all players which in some cases include state-owned companies, and providing forums for industry-government dialogue.

80. Another important element has to do with the readiness and availability of human resources. Does the country have the knowledge and skills required to design, implement, and use the new ICTs? Is the target workforce equipped with skills to take advantage of new production technologies? Is the general population knowledgeable on how to use the technology? Addressing these needs require formulating national education and training policies, institutions, and programs to develop the appropriate human resources.[55]

81. When it comes to building the KBE through an ubiquitous network society, the requirements include not only technology upgrading but also research, appropriate education and possession of IT skills, protections for security and privacy, partnerships between the government and the private sector, and clear plans at the national and local levels.[56]

---

[54] Dryer, D.C., C. Eisbach, and W.S. Ark. 1999. At what cost pervasive? A social computing view of mobile computing systems. *IBM Systems Journal*, Volume 38, Number 4.
[55] See footnote 49.
[56] Asian Institute of Technology. 2006. *Ubiquitous Network Society and the Knowledge-Based Economy*. Draft paper.

D. Setting the Policy and Regulatory Environments

82. Asian governments' roles and decisions to moving their nations toward a KBE/KBD vary, but the general pattern spans three areas:

(i) Policy: legislation, organization/reorganization, and regulation
(ii) Planning: formulation of vision, strategy, and road map
(iii) Infrastructure and programs: establishing and implementing the needed physical, institutional, and social infrastructure and programs, including pilot projects along the three areas of human resources development, ICT infrastructure/institutions, and science and technology development or innovation system. This area is covered in Sections II.A to II.C above.

1. Policy

83. Rapid technological developments are rendering some laws obsolete. For example, technological convergence—technological developments which blur the boundaries between erstwhile distinct industries or business sectors like communications, computation, education, and entertainment—results in laws designed for separate industries that are inadequate or inappropriate. Unless new enabling legislation is enacted, electronic documents are inadmissible in court. Electronic cross-border transaction has created the issue of which authority will tax and how it would be done. Without deliberate laws and affirmative policies, access to ICT would favor the already wealthy and could exacerbate existing income gaps.

84. The experiences of developed countries indicate that governments need to establish three conditions to attract investment, reduce transaction costs, and sustain economic growth: accountability, property rights, and the rule of law.[57] The quality of governance necessary to create these national conditions should continue to be applicable along the route toward KBE/KBD. An issue is whether, or how best, to apply these criteria to fast-developing countries in Asia with different cultural and historical experiences from developed countries in Europe and North America. For example, weaknesses in the PRC's property rights regime and contract law and enforcement—affecting innovation and joint ventures—are being felt most in Shanghai, a leading high-growth area in the PRC, which is deliberately planning toward KBE.[58]

85. The shift of commerce toward more online transactions requires creating the legal and regulatory environment to build trust and confidence among businesses and consumers. Electronic security, privacy of communications, protection of consumers (delivery guarantees, quality guarantees, credit card information security, etc.), and effectively checking cyber crime and spam are the issues that have to be effectively settled to build the additional trust needed for e-commerce. Internet has lowered costs of entry to new business and encouraged rapid growth of online SMEs. As a consequence online buyers are unsure of the reliability or trustworthiness of these small firms compared to more well-known large firms unless mechanisms are set in place to establish the needed trust. An emerging regional issue is dispute resolution arising from cross-border online transactions: Which country has jurisdiction over which aspect of the transaction?

---

[57] Timmer, C. Peter. 2006. *How Countries Get Rich. Center for Global Development*. Available: www.cgdev.org/files/6238_file_How_Countries_Get_Rich.pdf

[58] Weiping Wu. Undated. Targeted *Public Policies in Shanghai's Path to a Knowledge-based Economy*. Available: http://iir.nccu.edu.tw/chinapolitics/rethinking/07.doc

86. Monopoly or oligopoly in telecommunications, mass media, and other service industries can tend to increase business costs of using ICT. For example, the Philippine government in the 1990s, through legislation and executive issuances, liberalized and deregulated telecommunications, inter-island shipping, power production, airlines, and banking to create a more competitive domestic environment, increase the quality of services and generally decrease the business costs.

2. Planning

87. Many Asian governments had adopted ICT or KBE/KBD road maps:

- PRC State Information Development Strategy (2006–2020)
- India Vision 2020 (2002)
- e-Japan Strategy (2001)
- e-Korea Vision 2006 (2006)
- Malaysia's KBE Master Plan (2002)
- Philippines' National Information Technology Action Agenda for the 21st Century or IT21 (1997; currently being revised)
- Singapore 21 (1997), ICT 21 Master Plan (2000)
- Thailand's IT 2010 (2001)

88. Among the more common and important concerns reflected in these road maps are: how to bridge the many digital divides, how best to mix national economic and social goals, selecting pilot or demonstration projects, etc. These are discussed in the next section of this paper.

III. SELECTED INITIATIVES AND GOOD PRACTICES FROM SIX ASIAN COUNTRIES

A. People's Republic of China

89. The PRC has taken a number of measures in its quest to jump from an agriculture economy to an industry economy, and then to a knowledge economy. In the mid-1990s, the country's development policy was geared toward science, technology, and education. It considerably invested in information infrastructure and pursued a reform process that would prepare its economy and society into entering the World Trade Organization.

1. Education and the Skilled Workforce

90. The PRC has made advances in education in recent years. Literacy has improved in the past decade to almost 90%[59] after dropping to the 80–85% range during the large-scale migration of rural labor to urban areas in the early years of market-oriented reforms. Enrolment rate of school age children has been around 98–99% during the past 15 years because of the compulsory education system. Primary-to-secondary school and secondary-to-tertiary school enrolment had grown dramatically, by over 20% and 50% respectively, from 1990 to 2004. The PRC's 1,731 colleges and universities produce 2.4 million graduates annually, thus building up a huge pool of scientists and engineers. The number of personnel engaged in scientific and technological activities in the PRC as of end 2004 is 3.48 million, including 2.25 million scientists and engineers.[60]

[59] The *PRC Statistics Yearbook 2005* reported national adult literacy (15 years or older) at 89.68%.
[60] The *PRC Annual Book of Statistics 2005.*

91. Despite these, the technical skills of the PRC's workforce are still considered weak. This may be partly attributed to the relative unpopularity of vocational education compared to tertiary education, compounded by the question of whether the curriculum of vocational institutions continues to be relevant to the business sector, which is reflected in massive retraining of employees. In 2004, 2.36 million students are enrolled in Internet-based courses, which graduated 0.39 million in 2004. Another key weakness in the PRC's education system is overemphasis on knowledge transfer rather than development of imaginative and creative capabilities.

2. National Innovation System

92. The PRC in 2004 has 2,678 researchers per million population, and 1,732 scientists and engineers per million engaged in S&T activities. Basic research is still weak; its current main advantage still lies in low technology rather than high technology; and its competitive advantage remains largely in unskilled and labor-intensive economic sectors. The Foreign Policy Centre describes the PRC as "a technologically hungry nation, good in development and adaptation of technology but not necessarily yet successful at independent innovation."

93. The PRC government is determined to innovate on its own as it emphasizes the concept of "Made by PRC" rather than "Made in PRC."[61] Its NIS is undergoing massive reorganization and reforms which started from the time that it resolved to become a market-based economy. For instance, PRC's universities and research institutes have been forced to engage in research that is related to market and industry activities.[62] Following the market reform of PRC education and scientific research systems, the growth of government budget funding is frozen or slowed down to encourage educational and research institutions to seek alternative funding sources in the market. High-tech industrial parks have also been promoted and have been flourishing, although technology diffusion beyond the parks is rather limited.[63]

94. PRC's weakness in innovation stems from fundamental and systemic sources:[64]

- Weak incentives or tax policies to encourage business enterprises and individuals to innovate,
- Weak intellectual property rights protection,
- Competition from foreign technologies that accompany the PRC's liberal policies to foreign direct investments,
- Lack of emphasis on creativity in the education system, and
- The lure of quick wealth from commercial ventures instead of from innovation and R&D.

95. Supported by government, the Chinese Academy of Sciences started the program Knowledge Innovation which aims to restructure more than 100 research institutes to make them more efficient in generating and applying knowledge. Other government support includes

[61] Foster, Christopher J. 2006. *China's Secret Weapon, Science Policy and Global Power*. Foreign Policy Centre. April.
[62] Liu, X. *China's National Innovation System: Weakness and Strength*. In *Trend Chart Report:* Annual *Innovation Policy for Asian Countries 2003–2004*.
[63] Dahlman, C., and J. Aubert. 2001. China and the Knowledge Economy: Seizing the 21st Century. *WBI Development Studies*. Washington, DC: World Bank.
[64] Personal communication from Jun Tian, Advisor, Regional and Sustainable Development Department (RSDD), ADB.

providing financial assistance and tax incentives to develop high-tech industries. The government has likewise undertaken a number of policies and measures related to the promotion of innovation, science and technology, and R&D.

3. Networks and ICT

96. A sharp digital divide can be observed between the eastern and western parts of the PRC in per capita telecommunications services consumption, with the east more developed than the west. The digital divide can be seen in 111.35 mobile phones per 100 urban households versus only 34.72 in rural households in 12 western provinces. To narrow down the divide, heavy capital investments have been made in the western hinterlands. The Ministry of Science and Technology has launched a program for western areas to build public information systems and communication infrastructure, conduct educational programs on ICTs, and promote hardware and software industries, including business network development.

97. The PRC has formulated a 15-year road map for information development, which the General Office of the Communist Party of China Central Committee and General Office of the State Council unveiled.[65] The strategy extensively deliberates on eight key aspects that include (i) promoting ICT of the national economy, (ii) popularizing e-government, (iii) establishing an advanced Internet culture, (iv) strengthening the ICT infrastructure, (v) exploiting information resources more efficiently, (vi) improving competitiveness of the information industry, (vii) strengthening ICT security, and (viii) improving skills set. The PRC has experienced the fastest expansion ever seen around the globe in ICT infrastructure development in the 1990s. As of mid-2006, it had 432 million mobile phone subscribers and 367 million landline telephone subscribers, or a national telephone penetration rate of 57 per hundred persons. About 94.4% of villages around the country have access to landline telephone services. Television and radio broadcast coverage are 95.29% and 94.05%, respectively. Colored television and computer penetration rates in urban households were 133.44% and 33.11% in 2004.

98. Different sectors are now benefiting from ICT in the country. Many hospitals now use video-based teleconferencing systems and telemedicine services. E-Forum on current affairs, news, economy, sports, and entertainment, among others, is also very popular to Internet users. E-Community services on health care, entertainment, training, and welfare have been implemented. The business sector is also being assisted in connecting to the Internet and developing their e-commerce capabilities.

99. The PRC has been engaged in an e-government program that involves establishing two unified intranet platforms for interconnection among government departments and extranet for the extension of professional services to the public. These platforms are: (i) 12 Golden Projects on 12 areas of high-level decision making including tax revenue, modernization of agriculture, flood prevention, and management of drought; and (ii) building of two information systems and four databases on population, natural resources, macroeconomics, and the corporate sector.[66]

4. Policy and Regulatory Environments

100. The PRC's policies related to its move toward a KBE are incorporated into its Tenth Five-Year Plan. Although expressed in broad terms, this plan highlights the importance of education and developing skills: "working on technological innovation and related basic

[65] Information Development Strategy 2006–2020.
[66] Huixin Ke. *Digital Review of Asia Pacific 2003/2004: People's Republic of China*.

research, pursuing wide-ranging education policies adapted to country modernization, and forming and attracting talented people, including high quality public servants, enterprise managers, and scientists." It also provides policy directions in ICT development, although some analysts say that it does not sufficiently emphasize building a dynamic telecommunications and information infrastructure that will allow the PRC to leapfrog into the knowledge economy.[67]

101. Policy reforms in innovation and R&D are massive and extensive in the case of the PRC compared with other countries in Asia. Its traditional policy focus is on supporting R&D directly by funding R&D in public research laboratories, or by providing research grants to different institutions. Now, government has focused its efforts on transforming big traditional organizations into market-oriented institutions. Emphasis is placed both on foreign or locally initiated R&D as it adopts the twin approach of attracting foreign direct investment and encouraging domestic entrepreneurship.

B. India

102. India is well positioned to take advantage of the knowledge revolution to accelerate growth and competitiveness primarily because of the skill and labor endowment of its citizens and its ICT capabilities. Once known as "a land of mystery" rich in culture and history, India has evolved into the "outsourcing center of the world".[68] In 2005, the National Knowledge Commission was established to guide the government into a KBE.[69]

1. Education and the Skilled Workforce

103. India has a critical mass of highly educated, skilled, English-speaking workers with cutting-edge IT and design skills. However, this remains only a small fraction of the population despite having a significant pool of knowledge workers in the country (more than in Japan and roughly the same as the US). A more relevant educational system, starting from primary school focusing on learning and creativity, is needed to ensure the development of future knowledge workers.

104. The Indian leadership is committed to increasing educational attainment. In 2001, the national program for universal elementary education, *Sarva Shiksha Abhiyan* or Education for All was initiated and the constitution was amended in 2002 to make elementary education a fundamental right of every child. Some private Indian companies such as Tata Group use advances in ICTs to deliver education more efficiently.

105. There is also a need to improve the quality of tertiary education, align the curriculum to market needs, and provide opportunities for lifelong learning to workers. In response, efforts to establish a top-quality university system for competitive higher learning, such as Indian Institutes of Technology, Indian Institutes of Management, Indian Institute of Science, and the Regional Engineering Colleges, have been undertaken.

106. India, however, continues to suffer from the migration of skilled workers, with many professionals leaving the country in search of better opportunities abroad. While some scholars

[67] See footnote 49.
[68] Rao, Madanmohan. *Digital Review of Asia Pacific 2003/2004: India,* 108.
[69] The National Knowledge Commission was constituted on 13 June 2005 as a high-level advisory body to the Prime Minister of India, with a mandate to guide policy and direct reforms. It's overaching goal is to transform India into a virbrant knowledge-based economy.

argue that this has translated into "brain gain," others still perceive this as a challenge that needs to be addressed.

2. National Innovation System

107. Innovation in India is concentrated in the South, where global high-tech production and offshoring activities happen. Universities and research institutions are abundant and are very much engaged in research. Although the private sector has increasingly funded its own R&D activities and big companies have supported educational institutions in carrying out R&D projects,[70] majority of India's private sector is still not very active in research, with their participations limited only to some clustering efforts. Linkages are weak and some NGOs have stepped in to attempt to establish these cross-NIS actor connections.[71]

108. The government plays a central role in the innovation system. It has recently formed the National Innovation Foundation as part of developing the S&T sector as contained in the 10th Five-Year Plan (2002–2007).

109. India has received much attention in the area of innovation primarily because of its growing outsourcing industry. Tsipouri et al,[72] in fact, identified India and the PRC, as two low-income countries with developing NIS that are "likely global players in the near future with crucial role in innovation."

3. Networks and ICT

110. India has been known worldwide as both user and provider of ICT tools. It has developed its IT-related industries including production of software, services, and content.

111. Locally, India uses ICT for a wide variety of areas. In the realm of information and knowledge sharing, initiatives include rural Internet kiosks, community e-centers, e-healthcare, geographic information systems (GISs), dairy sector applications, teacher training, online agricultural systems, wireless local loop solutions, databases of rural innovations, and other services targeted at women and children. In the realm of public service, e-Government projects include online delivery of land titles, land and property registration, and empowering dairy farmers through a dairy information and services kiosk.

112. About 150,000 websites are focused on India, with an increasing number of locally developed content. In business, relevant information are shared by private e-commerce sites such as Rediff.com (publishing book reviews), business portals like SteelRX (updates on the steel industry), e-trading sites like ShareKhan and Indiabulls (giving information on stock market movements), and public sites publishing reference information online. Websites on entertainment and sports also abound. NGOs have also used the Internet to assist the vulnerable and the marginalized, providing information and access to support groups virtually.

---

[70] Kumar, J. 2004. *India: Transition From Production-Based to Knowledge-Based Economy: An Overview.* Report of the Asian Productive Organization (APO) Survey on In-Company Training Strategies for Knowledge Workers. Taipei,China: APO.

[71] Tsipouri, L., A. Zygoura, and V. Patsatzis. 2005. *Annual Innovation Trends Reports for the PRC; India; Indonesia; Japan; Korea; Malaysia; Singapore; Taipei, China; Thailand.* European Commission.

[72] See footnote 49.

4. Policy and Regulatory Environments

113. While the digital divide has affected India, as in most developing countries, the government's solution goes beyond providing basic Internet access. Eight key factors known as 8 Cs were identified as the key to unlock ICTs for development. These are: connectivity, content, community, commerce, capacity, culture, capital, and cooperation.[73]

114. The introduction of current account convertibility and easing of controls and regulations in the early 1990s and the Broadband Policy of the Indian Government in 2004 (providing an impetus to broadband and Internet penetration in the country) have enabled knowledge capture in the country.

C. Republic of Korea[74]

115. The Republic of Korea (ROK) has come a long way from the 1960s from when it had one of the lowest per capita incomes in the world to the present vibrant economy that has undertaken reforms in financial, corporate, and government sectors.

1. Education and the Skilled Workforce

116. Education has been receiving huge investments and attention in the ROK, but it still has several weaknesses. The country's formal education is considered too academic as opposed to being practical and creative, use of English remains low, and linkages to the labor market remain poor. Adult learning opportunities are also considered limited.

117. In 1996, Korea Education and Research Information Service, an organization that aims to provide an open and flexible venue to learn and to develop educational resources through ICTs, launched EduNet. It is a comprehensive educational information service system that allows all citizens—including students, teachers, and the general public—to gain access to valuable educational information via the Internet. Through EduNet, educational resources can be shared, online learning communities can be created, and personalized services can be provided. For example, teachers can access multimedia databases and courseware for their own learning and instructional activities. Students benefit from individualized education services such as online educational and personal consultation and entertainment. EduNet has become the biggest educational information network service system in the ROK.

118. The Government is likewise providing various educational opportunities to "Internet illiterates." These trainings developed into a systemic government-wide education project called "IT Education for 10M People," which began in 2000. This project has educated the farmers, fishermen, housewives, and the disabled.

2. National Innovation System

119. The ROK has a centrally managed innovation system, with innovation policies coordinated at the level of the Prime Minister. The business sector is dominated by a small

[73] Rao, Madanmohan. 2002. *The Asia-Pacific Internet Handbook, Episode IV: Emerging Powerhouses*. New Delhi: Tata McGraw Hill.

[74] References for this section are: (i) Hwang, Jong-Sung. *Digital Review of Asia Pacific (2003/2004)*. Eul Yong Park; (ii) Soo, Joong Hae. 2002. *Building a Knowledge-Based Economy: The Case of Korea*. Handong University; and (iii) Korea Development Institute. *Korea's Transition to a Knowledge Economy: Challenges and Policy Response*. (Joint Workshop on Knowledge Economy for Asia, 8 October 2004).

number of conglomerates that engage heavily in R&D and have produced innovative products marketed to the rest of the world. These private players are increasingly being encouraged to participate in policy formulation as well. Research excellence is stressed with emphasis on developing innovative technology that can provide sustained national competitiveness in the future. High-tech industries are likewise promoted.

120. However, ROK's resulting R&D outputs are not commensurate to its R&D inputs.[75] Local talents are also insufficient. To address these, the Government has improved the system for selecting research subjects and has helped establish effective research management methods to efficiently use R&D funds and maximize the benefits of R&D.

121. To promote basic research in ICT, the Government invested $88.4 million in the first half of 2001 to support R&D activities of small- and medium-sized venture businesses, help develop information and communication polices, establish e-libraries, and construct next-generation Internet platform. Time after time, the Government looks at leading technologies to appraise their technological and commercial merits, and to provide marketing and commercial support to create demand.

3. Networks and ICT

122. The ROK is among the Asian countries that have developed internationally known ICT companies and brands. The Government continues to boost private sector performance by designating core technologies including next-generation Internet, optical communications, digital broadcasting, wireless communications, and computer software, for development through advanced ICTs. Since private sector investment in this area is low and commercialization in the short-term period is generally not feasible, the Government invested $120.7 million to gain technological competitive edge in the world market.

123. SMEs also benefit from government assistance in ICT through the Small Enterprise Networking Project developed in 2001. With the observation that 99% of SMEs fail to maximize use of ICT, the goal of the project is to connect SMEs to the Internet and enable them to use ICT services by providing both hardware and training requirements by the government.

124. In the telecommunications sector, ICT standardization criteria have been implemented to enhance testing and certification systems of telecommunication equipment and to improve processes for regulating technical standards. Telecommunication companies also have been given financial support to construct high-speed information networks in remote areas and sponsor basic computer literacy programs since 2000, contributing significantly to the narrowing of the digital divide.

125. E-Governance is also an area that the ROK has explored as early as 1987. The Government launched the National Basic Information System to deploy ICT applications in its five core areas—administration, finance, education and research, national defense, and public safety. At present, e-government efforts have already translated into observed benefits, including the reduction of logistic cost for import and export procedures given the streamlining of customs administration, the decrease in number of required documents for port administration from 75 to 16, with accompanying decline in processing time from 2 hours to only 2 minutes.

[75] Park, E. Yong. 2002. *Building a Knowledge-Based Economy: The Case of Korea*. Handong University.

4. Policy and Regulatory Environments

126. ROK's policy direction is captured in the country's third ICT master plan called e-Korea Vision 2006. The plan's three goals are to: (i) improve social systems and productivity, (ii) transform the relationship between the Government and the market (to allow the private sector to thrive and be creative), and (iii) encourage the pursuit of a "lead strategy" (as opposed to the "catch-up strategy stated in previous plans) in key services and technology sectors.

127. The ROK also enacted a comprehensive set of legislation to set the stage for KBE:

- Utilization and Security of the Information System and Protection of Personal Information Act,
- Digital Signature Act,
- Framework on e-Commerce Act,
- Promotion of the Digitization of Administrative Work for the e-Government Realization Act,
- Management of Digital Content Act,
- Closing the Digital Divide Act,
- Protection of Major Information Infrastructure Act,
- Privacy Act,
- Public Record Management and Public Institution Act,
- Software Industry Promotion Act,
- Consumer Protection in E-Commerce Act, and
- Laws on Protection of Intellectual Property Rights.

D. Malaysia[76]

128. Malaysia envisions itself to be a fully industrialized nation with a KBE and the Government has been actively launching programs to make this a reality.

1. Education and the Skilled Workforce

129. Improvements in enrolment at the tertiary level (by 25%) have been made following substantial government budgetary allocation. However, enrolment is skewed toward art courses than the sciences, resulting in an inadequate pool of knowledge workers, scientists, and skilled workers. The learning abilities and skills of Malaysian graduates have also been noted to be inadequate.

130. In response to these, the Malaysian government is now focusing on three main strategies in education. First is the promotion of lifelong learning which includes retraining and re-skilling of workers, the provision of distance learning and virtual learning programs, and coordination with the private sector to provide incentives for skills upgrading. Second is the re-orientation of the education and training systems to prioritize the sciences and to encourage university–industry tie-ups. Last is attracting global talent through a brain drain program.

131. The brain drain program, revived in 2001, takes the form of a returning scientists Program. Incentives in the form of income tax exemptions, and car import duty and sales tax

[76] References for this section are: (i) Nain, Zaharom. *Digital Review of Asia Pacific 2003*/*2004, Malaysia;* and (ii) *Knowledge-Based Economy Master Plan. Malaysia*. Available: www.epu.jpm.my/new%20folder/publication/knoweco.htm

exemptions, among others, are being given to returning scientists in the fields of ICT, science and technology, industry, finance and accounting, arts, and medicine and health.

2. National Innovation System

132. Malaysia acknowledges its weak innovation performance, considering its low R&D expenditure in relation to GDP and the small number of patent applications, which was only a small fraction of the applications in Japan and the ROK. Industry–academe linkage also remains weak.

133. Innovation in Malaysia is currently hindered by the low number of scientists and engineers per million population. As a countermeasure, Malaysia has launched initiatives to attract skilled personnel, but this has not been very successful.[77] The weakness of Malaysia also comes from a dominant SME sector that is locally oriented and with serious handicap in technological capacity. Weak linkages with other NIS actors further worsen the situation. Responding to this situation, the Government has established a Multimedia Super Corridor (MSC) which is envisioned to serve as a test bed for invention, research, and other ground-breaking multimedia developments. With this, several multinational companies (MNCs) have been encouraged to locate in Malaysia and perform their R&D activities there, given the increased provision of state-of-the-art technology infrastructure.

3. Networks and ICT

134. Malaysia uses ICT both for community and business sector development. Two samples of community-directed projects are the TaniNet Project and CyberCare. TaniNet is an ICT-based portal developed to enable farmers to use the Internet as a communication tool and as a venue to share information and trends in agriculture and biotechnology. CyberCare, on the other, is intended for underprivileged children, particularly those in orphanage communities. It builds an online community of children, administrators, corporations, government sectors, and the community-at-large.

135. In business and private sector development, the most popular ICT initiative of the government is the setting up of the MSC in 1996. The MSC provides an ideal technological environment that is expected to attract knowledge workers, technopreneurs, and high-technology industries. Another example is the Flagship Applications project, implemented in 1997, that has two major components: multimedia development which offers business opportunities including e-government, multipurpose card, smart schools, and telemedicine; and multimedia environment, providing both Malaysian and international companies the opportunity to work closely with leaders in the multimedia industry, research and academic institutions, and customers.

136. Numerous e-governance initiatives also exist in Malaysia. These include the Generic Office Environment; the Human Resource Management Information System; Project Monitoring System; Electronic Procurement System; Electronic Labour Exchange e-Services (electronic delivery services of driver and vehicle registration, licensing and summons services, utility bill payments, and the Ministry of Health online information); and the Electronic Government–Accountant General Integration.

[77] Thiruchelvam, S.K., and K.Z. Ahmad. 2005. The War for Brains: Attracting Scientific and Technical Talent to Malaysia. Forthcoming paper for Asialics, Republic of Korea. Available: www.asialics.org

4. Policy and Regulatory Environments

137. Malaysia started its journey toward KBE in the 1990s when Vision 2020, the country's national agenda, was launched. In support of this, a KBE Master Plan was formulated and seven strategic thrusts were identified:

- Cultivate and secure the necessary human resources;
- Establish the institutions necessary to champion, mobilize, and drive the transition to a KBE;
- Ensure that the incentives, infrastructure, and info structure necessary to prosper the application of knowledge in all sectors of the economy and the flourishing of knowledge-enabling, knowledge-empowering, and knowledge-intensive industries;
- Dramatically increase capacity for acquiring and applying science and technology (including information and communication technology) in all areas;
- Ensure that the private sector is the vanguard of KBE development;
- Develop the public sector into a knowledge-based civil service; and
- Bridge the knowledge and digital divides.

138. In support of this plan is the National IT Agenda which is a framework for the development of the country into an information and knowledge-based society by 2020. It places importance on the development of people, info structure, and applications for "creating value, equity and access and qualitative transformation." The agenda focuses on five key areas: e-economy, e-community, e-sovereignty, e-learning, and e-public services.

E. Singapore[78]

139. From the time it gained its independence in 1965, Singapore has grown to be a major economic player in Asia, ranking third as an Asian financial center.

1. Education and the Skilled Workforce

140. Singapore's leadership believes in "investing heavily in upgrading the skills of the workforce because on an intelligent island, a pair of hands has to be a pair of thinking hands."[2] Faced with the challenges of an aging workforce, with older workers possessing low skills, a serious mismatch of skills, and the population's weak preference to go to vocational schools, Singapore has taken a number of steps to boost the quality of its labor force.

141. Collaboration between the ICT industry and schools has enabled the use of broadband to enhance the teaching and learning experience among schoolchildren. All public schools in Singapore have broadband access. In the case of tertiary education, a variety of e-learning institutions—such as the National University of Singapore, Nanyang Technological University, and Singapore Management University—is available.

142. A key promotional effort of the Government targeted toward developing competencies, particularly new, critical, and specialized ICT skills, is the enhanced Critical Infocomm Technology Resource Programme which has upgraded the skills of 3,900 ICT professionals in

[78] The references for this section are: (i) Goh Seow Hiong. *Digital Review of Asia and the Pacific. Singapore. (2003–2004)*; (ii) Prime Minister Lee Hsien Loong, *NewsWeek* February 2006 Special Edition; and (iii) Chia Siow Yue. *Singapore: Towards a Knowledge-Based Economy*.

new technology areas like bioinformatics, Linux, and XML. The Government also has the Infocomm Training and Attachment (iTA) Scheme that provides training on latest technologies with selected organizations in the ICT industry.

2. National Innovation System

143. Singapore aims to attract global industry players and position itself as a living laboratory for innovation in Asia. It does have a strong infrastructure and macroeconomic fundamentals that can support innovation. One of their most prominent R&D facilities, the Laboratories for Information Technology, has research facilities for a wide variety of fields, including media engineering and management, language engineering and knowledge management (KM), ubiquitous and distributed systems, and bioinformatics and medical imaging. With its global connectivity, more than 6,000 multinational and local wireless players have established their wireless R&D and test-bed activities in Singapore.

144. Private agencies, rather than the Government, spearhead Singapore's innovation. Being the hub of major MNCs in Southeast Asia, Singapore's initial research activities were influenced by these large MNCs operating in the country. Technology transfer did take place, with local companies being able to benefit from MNC-introduced technologies.[79] Currently, Singapore is focusing its efforts on improving its local entrepreneurship and upgrading their technological level through assistance schemes aimed toward businesses and industries. Collaborative government-funded projects, such as in the area of mobile payment infrastructure and application service providers, are also being promoted among local players.

145. A positive result that has been observed is the increase in the number of high-tech start-ups. Totaling 35, these were spun off by different research institutes and centers all managed by the National Science and Technology Board.

3. Networks and ICT

146. Singapore is among the most developed in Asia in terms of ICT and ranked 11th in the world as indicated in its information society index ranking, an ICT index composed of 23 variables. To illustrate, the national communications infrastructure has a 99%, island-wide broadband connection. Its Internet data centers have regional and international points of presence and use Singapore as a gateway to the region.

147. Through the e-Government Action Plan and the e-Citizen portal, a wide range of services is now available to the public. About 1,625 public services are available online representing about 83% of all government services considered feasible for e-delivery. To increase adoption of these ICT-enabled services by the general populace, the Government continuously promotes an e-lifestyle. Through the Singapore Infocomm Technology Federation, government support is also being provided to the business sector in the form of assistance to local companies in marketing their goods and services locally and internationally, and facilitation of knowledge exchange and transfer between local companies and international partners in areas such as benchmarking and competency and standards compliance.

148. With continued government support, the ICT industry in Singapore remains vibrant. Schemes, such as the International Content Hosting Scheme and the Content Enrichment

[79] Hang, C., and M. Ng. 2004. *IP and Innovation: Singapore's Experience*. Singapore. Available: www.eng.nus.edu.sg/cmost/ISMOT%20Paper%20_final_.pdf

Scheme, have been developed to attract high-end media-rich content to Singapore and extend broadband content to new systems. Programs such as the Infocomm Local Industry Upgrading Program tie up local companies with MNCs for exposure to the latest technologies. MNCs learn to apply their technologies to locally developed products and services, while local companies are able to tap the global marketing and distribution expertise of these MNCs.

4. Policy and Regulatory Environments

149. Singapore has the ICT 21 Master Plan which has three strategic thrusts: (i) to develop ICT as a major growth sector, (ii) to leverage on ICT to boost the competitiveness of key economic sectors, and (iii) to prepare Singapore for the information society of the future.

150. Singapore's policies go beyond the country. For instance, an e-ASEAN Framework Agreement has been put in place to enhance collaboration among the 10-member ASEAN organization to develop a common marketplace for ICT goods and services, facilitate infrastructure investment, and develop the infrastructure and policy framework for e-commerce and e-government.

151. Beyond the region, Singapore has also been actively pursuing free trade agreements (FTAs) with its major trading partners such as Australia, Canada, India, Japan, Mexico, New Zealand, US, and European Union (EU). These FTAs aim to further improve trade and investments with these countries by lowering tariffs for ICT goods, simplifying customs procedures, and improving market access for commercial and professional ICT services.

F. Thailand[80]

1. Education and the Skilled Workforce

152. In recent decades, Thailand's development strategy focused on education and knowledge building. With this focus, high literacy rates and high levels of economically active individuals were reached. However, with the advent of KBE, some concerns regarding Thai education and quality of manpower surfaced. Among these are the lack of relevance of the curriculum to the needs of the industry and the weakness of science and engineering programs.

153. Efforts to address these concerns include the promotion of vocational institutions and the provision of occupational training for knowledge workers by the Department of Skill and Development. In addition, many other departments, including the Department of Vocational Education, Ministry of Education, Department of Skill and Development, and Ministry of Labor, will also provide nonformal education on vocational training.

154. The importance of human resource development is highlighted in the Government's Ninth Economic and Social Development Plan. Phrased as "a knowledge-based and learning society," the Government believes that creative and rational thinking, developed through lifelong learning, is key to empowering the Thais.

[80] The references in this section are: (i) Makishima, Minoru and Somchai Suksiriserekul. *Human Resource Development Toward a Knowledge-Based Economy: The Case of Thailand*. Chiba, Japan: Institute of Developing Economies, Japan External Trade Organization; (ii) Koanantakool, Thaweesak. *Digital Review of Asia Pacific 2003/2004, Thailand*; and (iii) APO. 2004. *Training Knowledge Workers*. Report of the APO Survey on In-Company Training Strategies for Knowledge Workers.

2. National Innovation System

155. Thailand has developed good IT parks equipped with physical and information infrastructure in favorable locations to encourage ICT development, including R&D. However, the lack of regulation regarding the software business and the complicated process for qualified non-Thai workers to obtain work permits has resulted in hesitant investors.

3. Networks and ICT

156. Thailand seeks to improve the welfare of its people by expanding their access to ICTs. For one, through the SchoolNet launched in 1995, Thailand offered the first network that provides universal Internet access to teachers and students in schools through dial-up mode. Through the Agriculture Information Network, farmers are provided online services such as risk assessment, agriculture warning system, and agriculture knowledge base. The Community Access Telecenters project, on the other hand, offers low-cost Internet access and assistance to poor communities through public Internet booths, telecenters to promote community product and local tourism, and provides automatic web translation services.

157. Thailand has been keen on e-government to effectively and efficiently use ICTs for government operations and public service delivery. In recent years, several government agencies have started offering online services to help provide the so-called “4Rs” or red tape reduction, rapid response, rural coverage, and round-the-clock services. These include online personal tax filing and tax payment services, online juristic entity registration, and downloadable forms and information.

158. SMEs have been the target of ICT awareness and utilization programs. ICT support for SMEs is in fact one of the strategies in Thailand’s IT Master Plan or IT 2010. The plan lays down the steps as follows: "set up the mechanics of transferring and absorbing the advanced and appropriate technology to SMEs, motivate to build SMEs alliance group to utilize the whole system of ICT in business management, promote e-Business development, use ICT for management in industrial sector, make the database for planning and service, develop SMEs Portal to serve entrepreneur, and build up the entrepreneurship."[81]

4. Policy and Regulatory Environments

159. Thailand embarked on its first national IT development plan in 1996. Known as IT-2000, the plan has a three-pronged development agenda—building an equitable national information infrastructure, investing in people to accelerate the supply of IT workers and develop an IT-literate workforce, and achieving good governance through the use of IT in delivering services to the public and in government administration.

160. In 2001, the second national strategic plan called IT-2010 was adopted. It has three crosscutting principles to support “ICTs for knowledge-based society and economy” framework. These are building human capital, promoting innovation, investing in an information infrastructure, and promoting the information industry. Five main areas for development were identified: e-society, e-education, e-government, e-commerce, and e-industry.

---

[81] *Policy Strategies for a Knowledge-Based Economy in Thailand*. 2002. Available: www.oecd.org/dataoecd/9/28/2482440.pdf

G. Drawing Lessons from Country Experiences

161. Several lessons can be drawn from the diverse experiences of these six Asian countries. Although these countries have their own unique paths based on their different realities, certain similarities of what contributed to the success of their efforts can be observed. Table 3 highlights the initiatives taken by these countries in terms of the four pillars of a KBE.

1. Strong Leadership and Political Will

162. Malaysia and Singapore show how important leadership is in ensuring that programs and projects designed to facilitate the transition of the country into a KBE are pursued. A clear vision serves as the starting point and this gets translated into programs that heads of states publicly push and promote. This has a ripple effect on the various government ministries and agencies that then become committed to the delivery and accomplishment of such projects. Malaysia's Prime Minister has extensively promoted and publicized MSC. Singapore's Prime Minister has been at the forefront of its KBE programs. The innovation system in the ROK is centrally managed, with innovation policies coordinated at the level of the Prime Minister.

163. Strong leadership is also manifested in the government's determination to pursue reforms that are necessary to push the country ahead. Singapore, for example, unveiled a program to fast-track the liberalization of its telecommunications sector in 2000, accelerating by 2 years the timetable for full competition in the sector and immediately lifting the foreign equity limits for securing licenses for public telecommunications.

2. Clear Policy Direction and Adequate Support for Implementation

164. The experience of Asian countries showed that visions have to be translated into clearly articulated policies that will then guide the design of plans and concrete programs of action. In fact, the pillar of "policy and regulatory environment" serves as the rule-setting foundation of all other pillars. Asian countries have demonstrated an appreciation of this, as shown in the various master plans and strategic plans that are in place. For example, Indonesia has recently acknowledged the inevitability of the KBE, has immediately crafted the vision of "Creating a Nusantara Telematic Society by the Year 2020" for its KTIN (*Kerangka Teknologi Informasi Nasional*), the National Framework for Information Technology. The importance of how policy drives action is shown in the case of India, where the lack of a clear innovation plan limits government initiatives only to the S&T aspect of innovation.

165. Support for the implementation of programs does not always require the allocation of government funds, although this was the case in financially endowed countries like Singapore. Tapping the private sector in the form of partnerships and collaboration to raise the skill level of the workforce, for instance, as in the case of Singapore, or in encouraging innovation, as in the case of the PRC and the ROK, are also viable and effective options that can be considered.

3. Strengthening Linkages with the Private Sector

166. The innovation experiences of Asian countries show that the private sector can play and does have a major role in the transition to a KBE. Specifically in the case of MNCs taking the lead in innovation, the government has taken steps to ensure that the local private sector, such as the SMEs, benefit from such MNC-led innovation through technology transfer and knowledge exchanges.

167. The role of the private sector in enhancing workforce skills has also become evident and Asian countries have linked up with industry to provide inputs on relevant skills and competencies that must then be the basis of curriculum development both by privately owned and state-run educational institutions.

4. Exploring Innovative Ways of Achieving Desired Outcomes

168. Creativity and innovativeness have delivered significant gains to improve the quality of education and the skill level of the workforce. ROK's self-education program, anchored on lifelong learning philosophies, allows Koreans to earn a degree simply by passing a Bachelor's Degree Examination Program even without attending regular college. Over 2 million have graduated from the PRC's distance education,[82] a program that uses innovative learning tools such as cable and satellite televisions, Internet-based cyber schools, and virtual classrooms to reach primary school students, teachers, and even agriculturists and farmers. India's computer-based functional literacy, initiated by the Tata Consultancy Services, uses a mixture of methods—teaching software, multimedia presentations, and printed materials—and employs animated graphics and a voice-over, to teach an uneducated person to read in a fraction of the time it takes to do this by conventional means. Indonesia also has developed an e-learning site called e-*dukasi* to improve the quality of high school and vocational school education, using the latest curriculum to develop online materials for both students and teachers.

5. Use of ICT for Marginalized Groups

169. Major benefits have been derived from the use of ICT to reach the "have-nots." Farmers and the rest of the agricultural communities have been the beneficiaries of ICT-enabled, web-based assistance such as information sharing, trend monitoring, and risk assessment, in countries such as Thailand, India, Malaysia, and Philippines. Poor communities and underprivileged sectors have been provided with access and online support through rural kiosks in India, the online community called CyberCare in Malaysia, the promotion of local products in Thailand, and the provision of IT education in the ROK.

6. Combining Modern with Indigenous Technology

170. Asian countries are rich in indigenous technology. Marrying traditional knowledge with modern technology can provide substantial benefits. This was the case in an Indian private-sector-research laboratory partnership project aimed at developing a new drug against a chronic skin disease called psoriasis. The partnership used a combination of indigenous knowledge and modern techniques to perform "reverse pharmacology," using purified extract from leaves of a traditionally recognized herbal medicine and performing modern standardized techniques to identify the constituents that can fight the disease.

[82] Chinese sources mention up to 30 million if you include formal and informal distance learning programs. Available: www.edu.cn.20010101/21934

Table 3: Matrix of Selected Asian Country Initiatives

Country	Pillar 1: Education and Skilled Workforce	Pillar 2: National Innovation System	Pillar 3: Networks and ICT	Pillar 4: Policy and Regulatory Environment
People's Republic of China	• Compulsory basic education program • Massive retraining of employees • Promotion of university education, especially in Shanghai • Relaxing restrictions on hiring graduates from other parts of the PRC	• Massive reforms in the NIS • Universities and research institutes asked to engage in market-related research • Promotion of high-tech industrial parks • "Knowledge innovation" program restructuring research institutes	• Heavy capital investments in the western part to address digital divide • ICT used in health, media, entertainment sectors • Assistance to businesses on e-commerce • "12 Golden Projects" on e-governance	• 10th five-year plan highlighting education and skills development, and ICT • Reforms on innovation and R&D
India	• With a critical mass of educated and IT-skilled workforce • Universal elementary education • Innovative use by private sector of ICT for education • Quality university systems being established • "Brain drain" to "brain gain"?	• With global high-tech production and offshoring activities • Research-oriented universities and research institutions • Support by big companies in carrying out universities' R&D • With a National Innovation Foundation to support S&T	• Has developed its own IT-related industries • Uses ICT for knowledge and info sharing across sectors, reaching even the rural folks • Some e-government services	• Has identified 8 Cs in using ICT for development • Adopted broadband policy for broadband connection in the country • Establishment of Knowledge Commission
Republic of Korea	• Huge investments by the government • EduNet project using ICT for students, teachers, and the general public • "IT Education for 10M People" educating farmers, fishermen, housewives, and disabled	• Centrally managed NIS • Private players engaged in research encouraged to join policy formulation • Promotion of high-tech industries • R&D support for SMEs • Government providing marketing and commercial support to leading techs	• With internationally known ICT brands • Government support to core technologies for development • Small Enterprise Networking Project to get SMEs connected to net • Government support to telecom companies to reach remote areas • e-governance in five core areas	• e-Korea Vision 2006 • A variety of legislation for the KBE

Country	Pillar 1: Education and Skilled Workforce	Pillar 2: National Innovation System	Pillar 3: Networks and ICT	Pillar 4: Policy and Regulatory Environment
Malaysia	• Promoting lifelong learning • Reorienting education and training systems to prioritize sciences • "Returning Scientists Program"	• Attracting back local talents capable of innovation • Launching of Multimedia Super Corridor	• Use of ICT for community—farmers, underdeveloped children • ICT for business • Flag Applications with Multimedia Development and Multimedia Environment • Several e-governance initiatives	• Vision 2020 • KBE Master Plan with seven strategic thrusts • National IT Agenda
Singapore	• Collaboration between ICT industry and schools • Broadband connection of all public schools • Critical Infocomm Technology Resource Programme for skills upgrading	• With very good R&D facilities to support private sector players • Innovation is private-sector-led • Focusing on upgrading tech level of local entrepreneurs • Increase in number of high-tech start-ups	• Among most developed in ICT • Services available to public through e-Government Action Plan and e-Citizen portal • Tie-ups between local companies and MNCs for tech transfer	• ICT 21 Master Plan • Regional participation and leadership • Pushing for free trade agreements with major trading partners
Thailand	• Focus on education and knowledge building • Promotion of vocational institutions	• Establishment of IT parks	• Expanding access to ICT of the marginalized • E-government and online services on 4Rs • ICT awareness programs for SMEs	• Second national strategic plan IT 2010 identifying five main areas for development

4Rs = red tape reduction, rapid response, rural coverage, and round-the-clock services; 8 Cs = connectivity, content, community, commerce, capacity, culture, capital, and cooperation; ICT= information and communication technology; IT = information technology; KBE = knowledge-based economy; MNCs = multinational companies; NIS = national innovation system; PRC = People's Republic of China; R&D = research and development; S&T = science and technology; SMEs = small- and medium-sized enterprises.
Source: Summarized by the author.

IV. KBE INITIATIVES IN PACIFIC COUNTRIES

A. Developing Human Capital

172. **Palau: Developing New Teaching and Learning Strategies.**[83] Recognizing the need to produce students who are ready for complexities, uncertainties, and new technologies in the global knowledge economy, Palau engaged in a project that brought technology to students and teachers and developed new learning and teaching approaches. The project was designed and implemented given the principles stated in the 2002 Master Plan for Education Improvement. It involved developing a framework for the professional development of teachers and principals, followed by intensive training. The training, undertaken over a period of at least 6 months, covered the actual use of computers in the classroom, the operation of specific software, and different strategies on integration and use. The professional development framework, on the other hand, revolved around acquiring necessary skills through a series of courses designed for teachers to develop, apply, and evaluate wanted skills and competencies. These competencies were identified as: technology awareness, technology identification and operation, applications, academic skills development, cognitive skills development, acquisition of information (research), presentation/production skills, interpretation skills, ethics, and technology in the community.

173. **Cook Islands: Enabling Women through ICT.**[84] Noting the need to develop ICT skills among the vulnerable groups in society, the National Human Resource Development implemented a computer-training program exclusively for women in Rarotonga who are looking at a career shift. The objective is to increase their employability by equipping them with the basic technology skills needed to survive in the workplace. The course offered was a National Certificate in Business Administration Level 2 on the New Zealand Qualifications Authority (NZQA) framework. Campuses of secondary schools served as training areas, providing access to a large number of workstations.

174. **Nauru: Providing Education through a Combination of Traditional and Modern Technology.**[85] Combining traditional technology with advanced technology—this is the concept behind a grant given to the University of the South Pacific (USP), the leading institution of higher education among Pacific island states. The project sought to combine the popular and proven radio technology and the existing satellite communication networks of the university to deliver education materials and information on community development to students and communities of Nauru. The project involves establishing a solar-powered educational radio station that can be used to deliver educational materials to USP students; provides training to primary and secondary teachers; and raises awareness on critical areas such as health, entrepreneurship, and environmentalism, among others. NGOs and similar interest groups will also be tapped to create and deliver targeted community-development programming. Such a radio station is envisioned to be managed and operated by the community; thus, training for interested community residents in management is part of the project. The project started in February 2006. Evaluation of this audio-based educational program will later be undertaken to determine what mix of materials work best in the case of Nauru.

[83] www.unescobkk.org/index.php?id=1697
[84] Vaa, Ruby: Cook Islands: ICT Use in Education. In UNESCO Meta-Survey on the Use of Technologies in Education. UNESCO
[85] www.apdip.net/projects/ictrnd/2005/l34-nr/index_html/view

175. **Solomon Islands: Exploring e-Learning for Rural Communities.**[86] A partnership between the Solomon Islands Ministry of Education and Human Resources Development, and the People First Network has co-funded a project that seeks to bring education to rural areas. Called the Education Sector Investment and Reform Program, the project seeks to establish e-learning centers in rural community schools in each province. One component of the project is capacity building for teachers and educators. Site selection and planning has already started.

176. **Regional: Distance and Flexible Learning for the Pacific through ICT.**[87] Despite time and space separation, students of 12 countries of the Pacific are provided with the opportunity for quality higher education through the distance and flexible learning programs of the USP. To cater to students even in remote and distant areas, USP taps its centers in these member countries to implement a well-developed e-learning program. The distance and flexible learning program began in 1970 when USP started offering credit courses through distance education. By 1976, 90 students were enrolled in 16 courses; by 2004, enrollment has ballooned to 15,000, with the students spread over 150 courses. These courses are at different levels, from pre-degree or preliminary courses, vocational degrees, and degree qualifications. Seven learning modes are offered under the program and students can choose depending on what suits them best. These modes include the use of print, post and radio communications; telephone conferencing; and e-mail. With the creation of a wide area network called USPNet in 2000, distance learning took on a more interactive stance. Lectures are delivered to students throughout the region real-time and online collaboration among students and professors was made possible. Learning materials also became readily available and accessible, with students from member countries and partner institutions in the US, Japan, and Australia having online access anytime of the day.

177. **Regional: Open and Distance Learning for Agriculture Development.**[88] The USP-School of Agriculture and Food Technology (USP-SAFT) in Samoa is the leading institution in agriculture in the Pacific islands. Through its distance and flexible learning program, SAFT offers agriculture degree courses to technical agriculture staff, extension staff, agricultural science teachers, and others in the field of agriculture. Because students may come from 12 countries, the programs involve the combination of different instructional media, including print-based materials, audiovisual materials, satellite tutorials, e-mail contact with tutors, and audio-conferencing. The curriculum is carefully designed and crafted based on the cultural and institutional characteristics of the region. For instance, some courses involve experiential learning activities undertaken with ministries of agriculture or education under the supervision of local staff. Regional stakeholders are involved in the course delivery, with agencies such as the Ministries of Agriculture, Ministries of Education, and NGOs contributing significantly by providing research inputs, staffing and training support, and needed facilities.

178. **Regional: Organizing ICT Knowledge Exchange in the Pacific.**[89] Since 2002, the Pacific Islands Chapter of the Internet Society has held an annual conference called PacINET to encourage sharing of experiences on the use of ICT in the Pacific islands. Participated in by practitioners, developers, researchers, programmers, and other groups and individuals in the field of IT, the conference covers topics such as client-server computing, e-government, Internet security, computer applications, database systems, e-health, rural/remote telecommunications, geographic information system (GIS), and remote sensing, among others. Several modes

[86] www.picisoc.org/tiki-index.php?page=WSIS
[87] www.usp.ac.fj/index.php?id=ourhistory
[88] www.upou.org/research/odlresearch/col_syn_final.pdf
[89] www.peoplefirst.net.sb/general/about_us.htm

comprise the conference such as traditional paper presentations, panel discussions and invited talks; and the more interactive modes of demonstrations, tutorials, and workshops.

B. Developing Networks and Support Institutions

179. **Cook Islands: Linking Primary and Secondary Schools**.[90] A wide area network now connects all primary and secondary public schools in the pilot project area of Rarotonga. Called the Education Wide Area Network Project (EduNet), the project is a partnership between the Ministry of Education and Telecom Cook Islands. EduNet provides government schools with access to e-mail and file-sharing facilities. The technology acts like an extranet that is not connected to the Internet. A mail server and a file server distribute mails, data files, and course programs. Files can be shared and accessed anywhere in the network. However, only one mailbox is provided per school, and access to the service is limited to school administration and staff. Establishing the Rarotonga intranet is only the initial phase of EduNet. The overall vision is to enable the Ministry of Education to implement its distance education program across the Cook Islands.

180. **Fiji: Telecenter Projects.** In 2005, the Fiji government launched a pilot project that established a telecenter in the village of Verata in the main island of Viti Levu.[91] A computer with dial-up access was provided to allow citizens to have online access. The project was of great interest particularly among high school students. Even students from nearby villages walk for hours to get to the telecenter, with online connection proving very useful to accomplish school work, projects, and assignments. The ITC Services of the Government sponsored a project called Rural and Outer Island Telecentre for Navua Rural Womens Group in the first quarter of 2004.[92] The objective is to work with commercially successful women's group in the rural area of Navua and make them more successful in their trades through the use of ICT. An example of a supplemental activity that uses ICT is an e-mail broadcast that promotes products to urban customers.

181. **Marshall Islands: Teleconferencing for Education and Health.**[93] At the College of Marshall Islands, computers and networks are used for developing ICT skills of students and for accessing notes and assignments posted by professors in the intranet. The ICT facility also enables the college to host a satellite service linked to Pan-Pacific Education and Communication Experiments by Satellite (Peacesat). This satellite is connected by landline to a second satellite used for the Emergency Service Center. This setup allows for teleconferencing to outside links established in Hawaii, Guam, and other Micronesian islands. It also provides Internet access and 10 voice links channel. The services are available to the college, the Emergency Center, the Ministry of Health, the Majuro Hospital, and the Pacific Regional Education Laboratory (PREL) in the Ministry of Education, through a network of landlines that connects all these agencies. PREL has been the regular user of the teleconferencing service, using the technology for staff training. Further developments are planned, particularly at the hospital where the technology will be used for telemedicine to bring health advice and consultations to remote areas of the Marshall Islands.

---

[90] Vaa, Ruby. Marshall Islands: ICT Use in Education. In UNESCO Meta-Survey on the Use of Technologies in Education. UNESCO.

[91] www.apdip.net/projects/e-government/capblg/casestudies/Fiji_Chand_Final.doc

[92] www.picisoc.org/tiki-index.php?page=WSIS

[93] Footnote 90.

182. **Marshall Islands: Enabling Health Care Professionals.**[94] In 2001, the National Library of Medicine launched a project targeted toward health care professionals in the Republic of the Marshall Islands. Computer equipment and an Internet link were provided to authorized medical professionals to provide them with a means to connect to one another and to other health professionals in different parts of the globe. This link also allows the transfer of medical literature from the National Library of Medicine.

183. **Solomon Islands: Connectivity for Remote Areas.**[95] Innovative technologies do not necessarily employ the most modern of technologies. In the remotest areas of Solomon Islands, one of the most innovative e-mail applications involves only a low-tech e-mail sent via high frequency radios run by volunteers and a proto-portal website. The project is called the People First Network (PFnet) launched by the Solomon Islands Development Administration Planning Programme. It focuses on providing e-mail access and Internet support infrastructure to facilitate communication and information access for remote provinces in Solomon Islands. Rural e-mail stations are equipped with a well-known and reliable technology based on short-wave radio, low capacity computers, and solar panels. Through this, community and national news, as well as official information, are made available to the rural community. For those who cannot use computers, manual messaging service is also available. Information and mails are transferred through connections made several times a day between the rural stations and the hub or base station in Honiara. E-mail is also exchanged between the PFnet's radio stations and the Internet. There are currently 12 rural e-mail stations, with 7 more ready to be established, and 15 more being planned. Up to now, PFnet is still evolving. Recent initiatives include the involvement of students in volunteer work, data and information collection on the country's nine provinces to serve as baseline information, and the launching of a website that will serve as an advocacy tool for Solomon Islands' microprojects, among others.

184. **Tonga: Bridging the Digital Divide.**[96] Tonga.Online (www.mulonga.net) brings Tonga and the Tonga voice to the Internet. A cooperation project of the Austria–Zimbabwe Friendship Association and an outcome of cultural exchange activities over the last 10 years, Tonga.Online focuses on bringing media, ICT, and arts to the Tonga people. The project does not only involve web presence and promotion of cultural activities online but also brings infrastructure to the Tonga minority through donor funding. ICT communities in Binga, Siachilaba, and Syanzyundu have been established by bringing Internet-connected computers to villages. These communities are areas or locations where anyone from the community can go to for computer use, printing, typing, Internet access, music recording, and scanning. In April 2006, the Austrian Development Agency has again provided financing for building and strengthening IT infrastructure in Binga and Gwembe Valley, establishing five more ICT communities.

185. **Regional: Bringing Modern Health Care to the Pacific.**[97] Using the Internet as a tool for information sharing and communication, the Fiji School of Medicine and the Pacific Islands Telecommunications Association launched the Pilot Telehealth Project aimed at bringing modern health care to patients anywhere in the Pacific region. Through this project, patients are able to have remote consultations and diagnoses with doctors and specialists in an urban area;

---

[94] www.peacesat.hawaii.edu/text/30PROGRAM/Past/index.htm

[95] Guild, Robert. Pacific Islands. In *Digital Review of Asia Pacific*. UNDP, IDRC, and Obricom Network of UNESCO Chairs, 2003/2004; www.peoplefirst.net.sb/general/about_us.htm; www.picisoc.org/tiki-index.php?page=WSIS. See also Kupiainen, Jari. 2005. People First Network Puts People First: Translocation and Agency of Solomon Islanders in the Internet. Available: www.globaledevelopment.org/ Seminar%20abstracts/kupiainen.htm

[96] www.mulonga.net/

[97] Guild, Robert. Pacific Islands. *In Digital Review of Asia Pacific*. UNDP, IDRC, and Obricom Network of UNESCO Chairs, 2003/2004.

community health information is disseminated; and doctors, nurses, and patients are able to have continuous professional education. Modern health care is extended to patients in distant locations through the use of store-and-forward technologies that transfer narrative and text information, together with high-quality still images, via webpages and e-mail. At the receiving end are specialists located in urban areas who render expert opinions based on the information provided. Where more information is necessary and particularly for difficult cases, communication is made via e-mail to the local service provider, thereby establishing a venue for dialogue between the two health care specialists. The Pilot Telehealth Project follows the model of the Western Pacific Health Net which provides telehealth services to US-affiliated countries in the north Pacific. It will be implemented via Internet and satellite network for areas without telecommunication facilities.

186. **Regional: Aiding Pacific Farmers via E-mail Network.**[98] The identification of pests plaguing crops in the Pacific islands used to be expensive and time-consuming. In the absence of crop protection specialists, farmers had to rely either on global databases or on physically sending the pests to overseas institutions for pest identification and treatment advice. Through an e-mail network called PestNet, rapid information service for plant protection is now made available to farmers throughout the Pacific. The network consists of over 350 subscribers from government agencies, NGOs, private sectors, farmers, and even students. Regional and international crop experts form part of the network, providing assistance without any charge. The technology only involves an e-mail list server and a web library that houses the pest database. PestNet has recently developed a web presence (www.PestNet.org) allowing it to expand its services. In addition to pest identification via sending of digital images, an online form for pest identification is available online. A photo gallery of pests and contact information of organizations working on plant protection are also provided.

187. **Regional: ICT for the Geosciences.** [99] The South Pacific Applied Geoscience Commission is an intergovernmental and regional body promoting sustainable development among the Pacific islands. One of its programs is Community Lifelines which is geared toward strengthening the capacities of member countries in terms of energy, water, health and sanitation, and ICT. The goal is to improve access to these resources for sustainable livelihood. Core to the Community Lifelines Programme is the development of a GIS to improve the planning, utilization, and management of water resources and the introduction of remote sensing or the capturing of aerial images primarily using satellite technology for water depth analysis or bathymetry. The introduction of such technologies are accompanied by trainings and capacity building among agencies and individuals whose work is related to managing marine and other water resources.

188. **Regional: Digitization Allows for Revisiting History.**[100] Historical records of the Pacific, particularly those produced during the American period, have been preserved through its conversion into microfilmed documents in the 1980s. In 1991, a federal grant given to the University of Hawaii at Manoa (UHM) provided an opportunity to transform these historical images into a format that is more stable and accessible. After an inventory of all holdings, 6,600 images were selected for digitization, with the files to be linked to online catalog records. These images depicted the Pacific islands' culture, including historical buildings, dances, art, costumes; political events such as the opening of Congress and inauguration of governments; and the US programs in health, education, and economics during the Trusteeship period. A

[98] www.PestNet.org
[99] www.sopac.org/tiki/tiki-index.php
[100] www.firstmonday.org/issues/issue5_6/cartwright/index.html

more recent grant allows for the inclusion of the oldest newspapers, mostly in Hawaiian language, in the digitization collection. Although the collection is accessible only at the UHM Library, the transfer of the images to a dedicated server for image files is now under way, together with the creation on online access and the distribution of CD-ROM versions for distribution to libraries in the Pacific islands. The digitization of the historical images allows for easier research and history writing. Six books making extensive use of the digital photographs in the archives collection at the UHM Library's Pacific Collection have already been published and two new projects are under way. It also provides students in history classes with graphical illustrations of how their past was like. The digitization technology involves microfilm scanning and flatbed scanning to create and edit digital files and convert them to PDF format. Given that the budget allows for only two 20-hour student assistants, the project relies on program interns from the Library School who provides services for free. The project serves graduate students with a very positive work experience, allowing them to practice the theories learned on creating digital collections.

189. **Regional: Using Satellite Technology to Aid in Land Grants.**[101] Land granting institutions stand to benefit much from data captured by satellites. In the case of the Peacesat satellite, however, data and information access was limited to operator-required Peacesat sites. Through a grant from the Agriculture Development in the American Pacific under the US Department of Agriculture, a technique was developed to remotely access Peacesat data. It utilized a public switch telephone system that did not require an on-site operator.

190. **Regional: Building ICT Capacities for Public Health Surveillance.**[102] The Secretariat of the Pacific Community has a project for improving the surveillance capacity of the health sector. The project involved securing local area networks and data storage and transmission systems in health departments across the Pacific islands, and assisting in the implementation of secure data collection and exchange in the area of outbreak-prone communicable diseases among the islands. Country-specific interfaces were to be developed.

191. **Regional: ICT for Enhanced Statistical Data Access and Use.**[103] The Pacific Regional Information Systems–Statistical Information for Pacific Island Countries project was launched in 2004 with the objective of increasing the accessibility and use of statistical data for better decision making. The project involved the establishment of a regional database housing economic and social data of different Pacific countries. This database will be accessible via the Internet and will be the main tool for the dissemination. Technical assistance will then be provided per country to maintain and update country statistics. Almost 30 participants from across the Pacific have attended trainings on website design and development, and 15 National Statistics Office websites have been published.

192. **Regional: Peacesat for Development.**[104] Peacesat uses satellite and satellite-related technology to lessen the ICT digital divide in the Pacific islands. Its mission is twofold: to facilitate development communications and to provide public service telecommunications. The first involves the use of ICT for capacity building of institutions and nations while the latter refers to the use of ICT for developmental projects in such areas as education, economic development, health, and research. Peacesat has been operating for 30 years and has since been used in numerous ICT-related projects in the Pacific.

---

[101] www.peacesat.hawaii.edu/text/30PROGRAM/Past/index.htm
[102] www.picisoc.org/tiki-index.php?page=WSIS
[103] See footnote 102.
[104] www.peacesat.hawaii.edu/text/01HOME/Welcome.htm

C. National Innovation Systems

193. **Papua New Guinea: National Agricultural Research Institute**.[105] The National Agricultural Research Institute was established in 1996. Its mission is to promote innovative agricultural development in Papua New Guinea through research, knowledge creation, and information dissemination. The Institute aims at wealth creation in the context of a KBE through its system for innovation and knowledge utilization. For example, it has identified 20 innovations developed by local farmers.

D. National Policies

194. **Samoa: ICT Policies and Strategies.**[106] **"**Information and communication technologies for every Samoan" is the overall vision that informs the policies and guidelines of Samoa's ICT policy and strategic plan. From an assessment of the needs and issues of Samoa and the requirements of the rapidly evolving times, four guiding principles have been identified. These are the attraction, development, and training of human resources that are knowledgeable in ICT; the establishment of necessary ICT infrastructure; cooperation among stakeholders; and the creation of appropriate policies and regulation. Specific policies have been identified along these four principles.

195. **Fiji: ICT Policies and Directions.**[107] The national policy direction and strategic framework for the development of ICT in Fiji is guided by the vision "to harness Fiji's ideal geographic location, competent workforce, and world-class information technology infrastructure to promote Fiji's international competitiveness and create a dynamic, vibrant, and well-connected e-society." The intended outcome is captured in the phrase "e-Fiji, the future online." This translates into three functionalities: an online government, an e-enabled business sector, and an e-empowered community. Strategies for the online government include encouraging the delivery of online public services, engaging in online government procurement, improving processes using best practices in ICT utilization, and creating a secure national information infrastructure to build confidence in e-transactions. Strategies for the e-business component include facilitating in a formal knowledge transfer program, stimulating the uptake of ICT, promoting innovation, attracting more ICT investors, and liberalizing the telecommunications industry. In terms of the e-empowered community, strategies include providing IT accessibility for all, developing the knowledge base through education, and creating an information technology talent capital. Key result areas and action items have been identified per strategy. Needed resources have been identified for implementation starting 2004.

V. ADAPTING THE KBD MODEL TO DEVELOPING COUNTRIES

196. The political, social, and economic conditions specific to a developing country determine how to adapt or develop an appropriate KBD model for that country. Bringing in the latest information and communication technologies or adopting approaches from more developed countries may not always work as well as expected. The full utility of a given technology depends much on the socioeconomic context within which it is used, e.g., availability of repair, fabrication and other support services, presence of needed telecommunication facilities or services, manpower with the right skills to use, access to spare parts, etc. The KBD model is not

[105] www.nari.org.pg
[106] http://wikieducator.org/Samoa/NationalICT
[107] www.fiji.gov.fj/uploads/ICTDEVELOPMENTPOLICY.pdf

only greater use of ICT, or introduction of e-commerce or e-governance, or setting up broadband networks. It includes these but it is much more.

197. The central ideas behind the KBD model are**:**

- Shifting value creation toward creation and useful application of human knowledge;
- Creation, development, and deployment of three types of knowledge assets for value creation through modalities appropriate to specific national and local contexts: knowledge embodied in people (human capital), knowledge embedded in formal or informal structures and processes (structural or process capital), and knowledge, information and support from relationships, linkages and networks (stakeholder capital).
- Attention to the three value domains of sustainable development—economic, sociocultural, and natural—and hence a strategic national perspective for leveraging on a country's unique mix of financial, intellectual, sociocultural, and natural capital.

A number of on-the-ground experiences in Asia and the Pacific can be found to illustrate these ideas.

198. **Leveraging on a Country's Unique Human Capital**. The maritime environments and cultures of Pacific and insular Southeast Asian countries have naturally engendered seafaring skills. The unique endowments of human capital in the maritime sector are the source of foreign remittances for countries like Tuvalu and the Philippines. The Tuvalu Maritime School[108] and the Papua New Guinea Maritime College are training institutions that leverage this asset for national advantage. Regional networks for knowledge sharing, mutual help, and coordination in this area exist, such as the Association of Maritime Education and Training Institutions in Asia Pacific[109] and the Regional Maritime Programme of the Secretariat of the Pacific Community.[110]

199. **Building on Indigenous Social Capital for Enterprise Development**. Every community has social capital—the informal network of clan, patronage, and other relationships characterized by trust, mutual assistance, loyalty, informal roles, unwritten rules, and standards of behavior. Hindustan Level Ltd. (HLL), a subsidiary of Unilever in India, is a $2.3 billion company with a widespread manufacturing and distribution system for fast-moving consumer products, which includes a rural direct distribution system called *Shakti*.[111] This distribution system is run by some 250,000 women entrepreneurs called *Shakti Amma*, identified and trained by HLL to service a community-based self-help group. Another similar but more famous example is the successful Grameen Bank set up by Muhammad Yunus, a wide network of self-help groups for microfinance that builds on existing informal social networks and indigenous entrepreneurial talents to accumulate financial capital for enterprise development. The success of similar community-based self-help groups in other countries suggest that entrepreneurial potential or talent is not absent in rural and remote communities.

200. **Optimum mix of Overseas Development Assistance, Private, and Public Investments in Various Forms of Capital**. Different communities and different countries have their own peculiar endowments, scarcities, and problems in supply and demand of various

[108] www.outlookindia.com/diary.asp?fodname=19990412
[109] www.ametiap.com/about/index.htm
[110] www.spc.int/maritime/index.php?option=com_content&task=view&id=14&Itemid=34
[111] Prahalad, C.K. 2006. The Fortune at the Bottom of the Pyramid: Eradicating Poverty through Profits. Pennsylvania: Wharton School Publishing.

forms of capital: human capital, natural capital, infrastructure, public institutional capital, knowledge capital, and business capital—these factors determine the optimum mix of private investment, public investment, and ODA.[112] This perspective is based on the following observations:

- Households and communities own or can access various forms of capital; these various forms—whether formal or informal, tangible or intangible—must all be recognized and considered in development financing.
- Savings must similarly be viewed from this broader perspective; development financing, private savings, and public investment must be considered together.
- Extreme poverty is often characterized by (i) deterioration of human capital and (ii) depletion of natural capital. Before savings can happen, ODA must address these two problems first, such as by the "Big Five" development interventions: investments in basic health, education, and safe drinking water/sanitation; agricultural inputs; followed by investments in power, transport, and/or communication services *(ibid.)*

201. **Setting Up Structural Capital that Empowers Farmers**. Low income is the end result of many factors; one of them is existing trading structure biased in favor of certain social groups. A solution is setting up an alternative structure which provides low-income groups a better choice. An example is *e-Choupals*, a network of 2,000 personal computer (PC) kiosks in rural agricultural villages, connected via Internet to large firms, agricultural researches, and national and global markets. It was set up by India's ITC Group, a diversified company with $2 billion annual revenues. Each PC kiosk is operated by a local farmer, the *sanchalak*, for the benefit of local farmers in an area. Through the system, local farmers are informed of, among others, current prices of produce in various market centers in India and abroad. The information allows them to make better choices on when, where, and how to sell their produce. By replacing the traditional *mandi* trading system, the farmers get 270 Indian rupees more income per ton of soya beans.[113]

202. **Innovating New Sustainable Enterprise Models**. Facilitating the process of creating value through knowledge creation is important from the KBD framework. This process is feasible even for poor and remote communities. UNESCO has adopted six Asia-Pacific Strategic Pillars. Pillars 5 and 6 are, respectively, "engendering a paradigm shift in tourism in favor of culture and nature conservation" and "stimulating creative enterprise and cultural industries in the poorest communities."[114] The strategy, in effect, is using, conserving, and building cultural capital and natural capital for enterprise development. Innovating new models of community-based cultural ecotourism enterprises appropriate to specific Asian and Pacific contexts is consistent with the KBD framework for creating value using the unique mix of capital available to a community. Some examples of innovative approaches and lessons learned in community-based biodiversity conservation are those documented by the United Nations Development Programme (UNDP)–Global Environment Facility (GEF) Small Grants Programme.[115]

203. **Knowledge Networking for Critical Capabilities**. Among island states in Asia and the Pacific, a critical set of capabilities is community-based management of coastal and marine resources. Networks to support exchange of knowledge and learning create value for its

[112] Sachs, Jeffrey D. 2005. *The End of Poverty: Economic Possibilities for Our Time*. New York: Penguin Books.
[113] See footnote 111.
[114] www.unescobkk.org/index.php?id=465
[115] www.undp.org/sgp/download/biodiversity_case_studies_english.pdf

members. An example is the Locally-Managed Marine Area (LMMA) Network, which links together various practitioners (conservation workers, community leaders/members, researchers, etc.) in coastal and marine conservation in the Fiji Islands, Indonesia, Palau, Papua New Guinea, Philippines, Federated States of Micronesia, and Solomon Islands.[116] The network exchanges experiences and lessons on what works, what does not work, and why in the operation of an LMMA, which is defined as "an area of nearshore waters actively being managed by local communities or resource-owning groups, or being collaboratively managed by resident communities with local government and/or partner organizations."

Tertiary education is another critical area for networking among Pacific island states with small populations that cannot singly support its own tertiary level educational institution. In this area, the role of Fiji-based University of the South Pacific is important in providing access to tertiary education via its distance learning modes and its branch campuses in the Cook Islands, Kiribati, Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu.[117]

VI. PROPOSED INITIATIVES

A. Country-Specific Initiatives

204. Developing countries in Asia can learn much from the experiences of other Asian countries that have already made advances into becoming a KBE. Important lessons have been discussed in Section 3.7. The following sections contain other lessons specific to each KBE/KBD pillar.

205. **Education and the Skilled Workforce**

- The need for improved management of primary and secondary education systems and curricula in light of its important function of providing the core foundations of learning, including "learning to learn" and other skills judged crucial for the 21st century by the Delors Commission of UNESCO.[118]
- The need to build effective learning environments and adopt more appropriate pedagogical approaches, including adult-oriented workplace learning methods.
- Educational institutions, particularly universities and vocational and technical schools, should reinvigorate their role as research and innovation leaders, serving in proactive knowledge creation more than reactive agents of knowledge transfer.
- Industry-academe tie-ups should be strengthened to ensure the relevance and appropriateness of curriculum and teaching methodologies to the business setting.
- Governments should reexamine their roles from financiers and providers to being direction-setters and enablers of the education sector, setting policies and directions needed by private sector players both in the fields of education and business. For instance, other Asian countries can explore Asian best practices in partnerships with the private sector to strengthen training provisions.

[116] www.lmmanetwork.org/Site_Page.cfm?PageID=8
[117] www.usp.ac.fj/index.php?id=campuses
[118] *Learning: the Treasure Within,* the report to UNESCO of the International Commission on Education for the Twenty-First Century headed by Jacques Delors. The Commission felt that education throughout life is based on four pillars: learning to know, learning to do, learning to live together, and learning to be.

206. **Building Networks and ICT**

- Policies and plans should be put in place to ensure that underprivileged groups are not deprived of equal access to ICTs and online services.
- Maximize the potentials of ICT through private sector collaboration particularly in areas of substantial social benefits such as e-learning and e-health.
- Ensure continuous skills development among those engaged in the ICT sector. Included here are skills in digital content generation and software design which are key skills needed not only in the ICT sector but across multiple sectors.

207. **National Innovation Systems**

- The enhancement of R&D capacity,
- The further strengthening of networking between universities and think tanks including linkages with business,
- Access and dissemination of S&T to local enterprises given that innovation is often initiated by and concentrated in large and multinational (western) organizations and government research institutes,
- The need to seriously implement policies on intellectual property rights and
- Easier access to seed capital to spur innovation of SME into business opportunities.

208. **Policy and Regulatory Environment**

209. Existence of a national framework that examines the linkages of the different elements of a KBE, a clear and coherent set of policies and strategies, and concrete plans translating policies and strategies into doable activities and programs;

210. Drafting of legislation and reform of the regulatory environment to enable new modes of e-business, to create a business environment of trust and confidence in online processes, control cyber crime, and reduce business costs arising from monopolistic/oligopolistic structures such as in the telecommunications sector;

211. Document best practices and innovate next practices in how to adapt KBD for maximum benefit of low-income Asian countries, such as (i) leveraging on a country's unique human capital; (ii) building on indigenous social capital for enterprise development; (iii) optimizing the mix of ODA, public and private investments using a wider perspective on capital; (iv) setting up structural capital to directly benefit farmers and other low-income groups; (v) innovating new sustainable community and household enterprise models; and (vi) setting up networks to facilitate exchange in knowledge and capabilities crucial for the poor in Asia.

B. Regional Initiatives

212. Aside from country-specific initiatives, regional initiatives can also play a significant role to guide developing countries to become KBEs/KBDs. These initiatives can be undertaken by ADB with assistance from KBEs in the Asia and Pacific region.

(i) **Formulation of a KBD Model.** There is a need to formulate the basic principles and operational implications and indicators of the KBD model, which combines at the national and regional levels two important emergent global development themes: sustainable development and knowledge management (KM). This could

include applying World Bank Knowledge Assessment Methodology (KAM), which provides a basic assessment of countries' and regions' readiness for the knowledge economy. ADB can develop or add new ones involving knowledge stocks and flows, particularly those relating to the diffusion of information technologies. It can do an analysis of social and private rates of return to knowledge investments to more correctly ascertain the impact of knowledge on productivity and growth. It can also develop new ways of measuring the functioning of knowledge networks and national innovation systems and the development and skills of human capital.

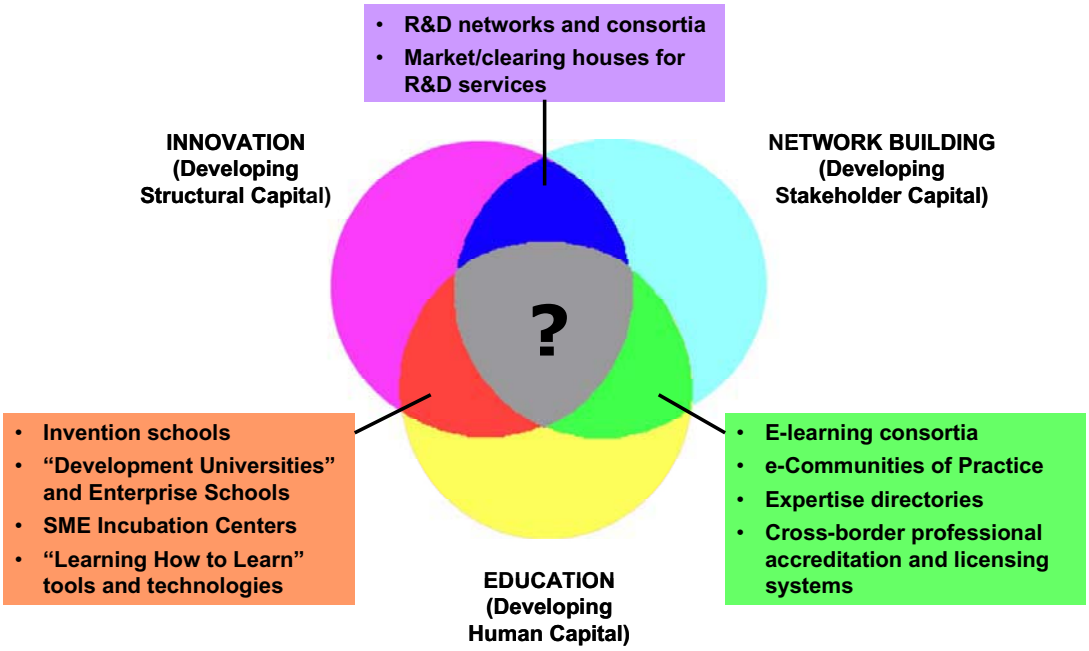
(ii) **Focused Anti-Poverty KBD Development Agenda.** There is a need to review more in detail priorities in development modalities and sectors and focus attention to specific areas of policy and governance to ensure that planned transition toward a KBE or KBD in an increasingly global economy will affirmatively engage lower-income groups and socially excluded sectors of society. Such a study could build upon many other development programs aimed at bridging the ICT divide (e.g., the World Bank's Information Technology for Development [IT4D] and Canadian International Development Agency's [CIDA] Pan Asia) but broaden the discourse beyond ICT toward KBD. A conference among stakeholders in the Asian region could be considered.

(iii) **Training of Economic/Development Planners and Establishment of an e-Community of KBD Planners in Asia.** There is a need to design and conduct a series of training courses for high-level economic/development planners in developing countries' economic or development planning ministries/departments to introduce: (a) the new paradigms of the knowledge economy, (b) the different behavior of information and knowledge as economic goods (e.g. appreciation of intellectual capital with use), (c) the KBD model, (d) survey of the best practices in Asian countries in planning toward KBD, (e) practice some of the tools in KM applied at the national level, and (f) set up an e-community of KBD planners for subsequent knowledge sharing and updating of knowledge in KBD in Asia.

(iv) **Cross-Leverage Knowledge Assets across the Asian Region.** There is a need to identify strategic KBE/KBD entry points at the regional level for facilitating cooperation and synergy among Asian countries as they transition toward more knowledge-based economies and societies. A cue in this direction is the observation that regional R&D networks (see Section 2.2.2) mutually leverage the value and impact of two categories of KBD: innovation and network building. This approach may be generalized to identify other two-way mutual leveraging at the regional level of knowledge assets (see Figure 3 below). A possible cue as to what are the institutional forms of three-way mutual leveraging (question mark in the middle of Figure 3) is the issue identified by the International Development Research Centre (IDRC)'s Research on Knowledge Systems (RoKS) project, namely, networking of "developmental universities" or those educational institutions/programs focused on on-the-ground innovation and entrepreneurship training and R&D.[119]

[119] See Research on Knowledge Systems at: www.idrc.ca/en/ev-8685-201-1-DO_TOPIC.html

Figure 3: Framework for Cross-Leveraging Knowledge Assets Across the Asian Region



R&D = research and development, SMEs = small- and medium-sized enterprises.
Source: Talisayon, Serafin. 2006.

(v) **Networking of Asian Institutions in Knowledge Management and Organizational Learning.** Sponsor (or co-sponsor with the Asian Productivity Organization) a conference where schools, universities, government institutes, and civil society organizations which are active in innovating, developing, and teaching new tools for KM and organizational learning can exchange and share experiences and set up an Asia-wide network for promoting and sharing tools in KM and organizational learning.

(vi) **Assist in Formulating KBE Plans.** In drafting a country planning strategy, for instance, attention could be given to incorporate a regional and/or national KBE vision, strategy, and program of action—based on best/good practices by Asian countries which had formulated and adopted such plans.

(vii) **Policy Study on Cross-Border e-Commerce.** There is a need to identify, anticipate, and propose regional solutions to problems, issues, and risks or vulnerabilities arising from cross-border e-commerce and cross-border trade or transfer of knowledge.

"What happens if the political entity in which you are located no longer corresponds to the job that takes place in cyberspace, or no longer really encompasses workers collaborating with other workers in different corners of the globe, or no longer really captures products produced in multiple places simultaneously? Who regulates the work? Who taxes it? Who should benefit from those taxes?" – David Rothkopf, quoted by Thomas L. Friedman in *The World is Flat: A Brief History of the 21st Century*, 2005.

REFERENCES

Abramowitz, Moses. 1989. *Thinking about Growth*. Cambridge: Cambridge University Press. Quoted in the Organisation for Economic Co-operation and Development (OECD). 1996 *The Knowledge-Based Economy.* Paris.

Asia Pacific Biotech News. Available: www.asiabiotech.com

Asian Development Bank (ADB). 2006. Asian Institute of Management: Enhancing the Complementarities of Education and Technology: Key to Transitioning to a Knowledge-Based Economy, Working Paper (Unpublished). Manila: ADB.

Asian Institute of Technology (AIT). 2006. *Ubiquitous Network Society and the Knowledge-Based Economy*. Draft paper.

Asian Productivity Organization (APO). 2004. *Training Knowledge Workers*. Report of the APO Survey on In-Company Training Strategies for Knowledge Workers.

Asia-Pacific Development Information Programme (APDIP). Bangkok, Thailand. Available: www.apdip.net

Baker, Dean. 2005. *The Social Security Shortfall and the National Defense Shortfall*. Center for Economic and Policy Research. Available: www.cepr.net/documents/publications/ss_defense_2005_04.pdf

Balzat, M. 2002. *The Theoretical Basis and the Empirical Treatment of National Innovation Systems.* Augsburg, Germany: University of Augsburg, Institute for Economics. Available: www.druid.dk/uploads/tx_picturedb/dw2003-693.pdf

Barré, R., V. Hernandez, J.-B. Meyer, and D. Vinck, eds. 2004. *Diasporas scientifiques, Expertise collégiale: Institut de Recherche sur le Développement*. Paris, France: Ministry of External Affairs.

Baruch, Lev. 2001. Intangibles: management, measurement and reporting. Brookings Institute Press.

Bourdieu, Pierre. 1986. The Forms of Capital. In *Handbook of Theory and Research for the Sociology of Education*, edited by John G. Richardson. New York: Greenwood Press.

Brown, M. 2002. *Intellectual Diaspora Networks: their viability as a response to highly skilled emigration in Fibbi.* In *Introduction: le lien plus que l'essence», Diasporas, développements et mondialisations*, edited by R. Barré and J.-B. Meyer. Paris: Institut de Recherche pour le Développement (IRD), Editions de l'Aube.

Carnoy, M. 1998. The Changing World of Work in the Information Age*. New Political Economy* 3(1):123-128.

Cartwright, James, Martha Chantiny, Joan Hori, and Karen Peacock. 2000. The Digital Landscape: The Hawaiian Newspapers and War Records and Trust Territory Image Repository of the University of Hawaii. *First Monday* Vol. 5, No. 6, June. Available: www.firstmonday.org/issues/issue5_6/cartwright/index.html

Chen, Derek H.C., and Carl J. Dahlman. 2004. Knowledge and Development, a Cross-Section Approach. *World Bank Policy Research Working Paper* 3366. Washington, DC: World Bank.

Chia Siow Yue. *Singapore: Towards a Knowledge-Based Economy*. Available: www.tcf.or.jp/data/20000127-28_Siow-Yue_Chia.pdf

Conger, Stuart. 1974. *Social Inventions*. Prince Albert, Canada: Saskatchewan Newstart. Available: www.innovation.cc/discussion-papers/stuije.htm

Dahlman, Carl J. 2002. *Knowledge for Development, Assessment Framework and Benchmarking*. Singapore.

Dahlman, Carl J., and Aanuja Utz. 2005. *India and the Knowledge Economy. Leveraging Strengths and Opportunities. WBI Development Studies*, Washington, DC: World Bank. Available: http://info.worldbank.org/etools/docs/library/145261/India_KE_Overview.pdf

Dahlman, Carl J., and Jean-Eric Aubert. 2001. *China and the Knowledge Economy: Seizing the 21st Century. WBI Development Studies.* Washington, DC: World Bank. Available: http://info.worldbank.org/etools/docs/library/137742/ChinaKE.pdf

Dahlman, Carl J., Jorma Routti, and Pekka Yla-Antilla. 2005. *Finland as a Knowledge Economy: Elements of Success and Lessons Learned (Overview)*. Washington, DC: World Bank.

Delors, Jacques. 1996. *Learning: the Treasure Within*. Report to the United Nations Education, Scientific and Cultural Organization (UNESCO). Paris: UNESCO. Available: www.teacherswithoutborders.org/pdf/Delors.pdf

Digital Opportunity Task (DOT) Force. 2001. Digital Opportunities for All: Meeting the Challenge, A Report of the DOT Force. 11 May.

Dryer, D.C., C. Eisbach, and W.S. Ark. 1999. At what cost pervasive? A social computing view of mobile computing systems. *IBM Systems Journal*, Volume 38, Number 4. Available: http://researchweb.watson.ibm.com/journal/sj/384/dryer.pdf

Economic Planning Unit, Prime Minister's Department. *Knowledge-Based Economy Master Plan: Malaysia*. Available: www.epu.jpm.my/new%20folder/publication/knoweco.htm

Fiji Government Online Portal. Policy Directions and Strategies for the Development of Growth and Information and Communication Technology. Available: www.fiji.gov.fj/uploads/ICTDEVELOPMENTPOLICY.pdf

Foster, Christopher J. 2006. *China's Secret Weapon, Science Policy and Global Power*. April. The Foreign Policy Centre. Available: http://fpc.org.uk/fsblob/753.pdf

Fukuyama, Francis. 1996. Trust: the Social Virtues and the Creation of Prosperity. New York: Free Press.

Ghate, Prabhu. 1999. Life on the Fringe. Outlook India.com. 12 April. Available: www.outlookindia.com/diary.asp?fodname=19990412

Global Maritime Education and Training Association. Available: www.ametiap.com/Website/OrgGensis.aspx

Goh Seow Hiong. *Digital Review of Asia and the Pacific 2003–2004: Singapore.* APDIP of the United Nations Development Programme (UNDP), Pan Asia Networking Programme of the International Development Research Centre (IDRC), Orbicom, and Southbound.

Guild, Robert: *Digital Review of Asia and the Pacific 2003–2004: Pacific Islands*. APDIP of UNDP, Pan Asia Networking Programme of IDRC, Orbicom, Southbound, and Agence intergouvernementale de la Francophonie.

Hang, Chang Chieh, and Marvin Ng. 2004. *IP and Innovation: Singapore's Experience*. Singapore. Available: www.eng.nus.edu.sg/cmost/ISMOT%20Paper%20_final_.pdf

Haque, Samudra E. *Digital Review of Asia Pacific 2003–2004: India*. APDIP of UNDP, Pan Asia Networking Programme of IDRC, Orbicom, and Southbound.

Hastings, David. Building Tomorrow's Corporate Portals (PowerPoint presentation). Computer Associates. Available: www.infotoday.com/KMWorld2000/presentations/hastings.ppt

Hobbe's Internet Timeline v8.1. Available: www.zakon.org/robert/internet/timeline/

Huixin Ke. *Digital Review of Asia Pacific 2003–2004: People's Republic of China*. APDIP of UNDP, Pan Asia Networking Programme of IDRC, Orbicom, and Southbound.

Hwang, Jong-Sung. *Digital Review of Asia Pacific 2005–2006: South Korea.* APDIP of UNDP, Pan Asia Networking Programme of IDRC, Orbicom, Southbound, and Agence intergouvernementale de la Francophonie.

International Commission on Education for the Twenty-First Century. 1998. *Learning: the Treasure Within.* Paris: UNESCO Publishing.

International Development Research Centre. Research on Knowledge Systems. Available: www.idrc.ca/en/ev-8685-201-1-DO_TOPIC.html

IT Strategy Headquarters. 2001. *e-Japan Strategy*. 22 January. Tokyo: IT Policy Office. Available: www.kantei.go.jp/foreign/it/network/0122full_e.html

Johnson, Bjorn, Charles Edquist, and Bengt-Ake Lundvall. 2003. *Economic Development and the National System of Innovation Approach*. Presented in the First Globelics Conference in Rio de Janeiro, Brazil, 3–6 November. Available: www.globelicsacademy.net/pdf/BengtAkeLundvall_ 2.pdf

Kiernan, Matthew J. 1995. *Get Innovative or Get Dead, Building Competitive Companies for the 21st Century*. Darby, Pennsylvania: Diane Publishing Co.

Koanantakool, Thaweesak. *Digital Review of Asia Pacific 2003–2004: Thailand*. APDIP of UNDP, Pan Asia Networking Programme of IDRC, Orbicom, and Southbound.

Korea Development Institute. 2004. *Korea's Transition to a Knowledge Economy: Challenges and Policy Response*. Joint Workshop on Knowledge Economy for Asia on 8 October.

Kothuri, Smita. 2002. *Knowledge in Organizations, Definition, Creation, and Harvesting*. May. Available: www.gse.harvard.edu/~t656_web/Spring_2002_students/kothuri_smita_knowledge_in_orgs.htm

Kumar, J. 2004. *India: Transition From Production-Based to Knowledge-Based Economy: An Overview.* Report of the APO Survey on In-Company Training Strategies for Knowledge Workers. Taipei,China: APO.

Kupiainen, Jari. 2005. *People First Network Puts People First: Translocalisation and Agency of Solomon Islanders in the Internet*.

Kuznetsov, Y., and C. Sabel. 2005. *Global Mobility of Talent from a Perspective of New Industrial Policy: Open Migration Chains and Diaspora Networks*. Paper presented at the United Nations (UN) Economic Commission for Latin America and the Caribbean (ECLAC)-UN University workshop on international mobility of talent on 26–27 April in Santiago, Chile. Available: http://info.worldbank.org/etools/docs/library/201210/Search_Networks_final1.pdf

Lallana, Emmanuel. *Digital Review of Asia Pacific 2003–2004: Philippines*. APDIP of UNDP, Pan Asia Networking Programme of IDRC, Orbicom, and Southbound.

Liu, X. *China's National Innovation System: Weakness and Strength.* In *Trend Chart Report: Annual Innovation Policy for Asian Countries 2003–2004*.

Liu, Xieling, and Steven White. 2000. Comparing Innovation Systems: A Framework and Application to China's Transitional Context. Mimeo. Beijing and Hong Kong, China.

Locally-Managed Marine Area. 2005. Available: www.lmmanetwork.org/Site_Page.cfm?PageID=8

Makishima, Minoru and Somchai Suksiriserekul, eds. 2003. *Human Resource Development Toward a Knowledge-based Economy: The Case of Thailand*. Chiba, Japan: Institute of Developing Economies, Japan External Trade Organization. Available: www.ide.go.jp/English/Publish/Asedp/066.html

Martinez-Cisneros, B. 2004. *National Innovation Systems: Lessons from East Asia to Latin America*, Case studies of Costa Rica and Chile. Georgia, US: School of Public Policy, Georgia Institute of Technology.

McLean, Scott, Alexander Flor, and Malcolm Hazelman. 2006. *ODL for Agricultural Development and Rural Poverty Reduction: A Comparative Analysis of Innovation and Best Practice in Asia and the Pacific (Synthesis Report)*. 31 March. University of the Philippines Open University. Available: www.upou.org/research/odlresearch/col_syn_final.pdf

Ministry of Information and Community, Republic of Korea. 2006. e-Korea Vision 2006. Available: http://unpan1.un.org/intradoc/groups/public/documents/APCITY/UNPAN008973.pdf

Mulonga.Net. Tonga. Available: www.mulonga.net/

Nain, Zaharom. *Digital Review of Asia Pacific 2003–2004, Malaysia*. APDIP of UNDP, Pan Asia Networking Programme of IDRC, Orbicom, and Southbound.

National Agricultural Research Institute. Papua New Guinea. Available: www.nari.org.pg

National Knowledge Commission, Government of India. Available: http://knowledgecommission.gov.in/

Ohio Department of Education. 1990. Ohio's future at work, Action plan for accelerating the modernization of vocational education in Ohio.

Opiniano, Jeremaiah M. 2004. *Our Future beside the Exodus: Migration and Development Issues in the Philippines*. Pasig City, Philippines: Friedric Ebert Stiftung. Available: www.fes.org.ph/pdf/Our%20Future%20Beside%20the%20Exodus.pdf

Organisation for Economic Co-operation and Development (OECD). 2001. *OECD Science, Technology, and Industry Scoreboard: Towards a Knowledge-Based Economy*. Paris.

———. 2002. *Definition and Selection of Competencies, Theoretical and Conceptual Foundations (DeSeCo)*: Strategy Paper on Key Competencies, a Frame of Reference for a Coherent Assessment and Research Program. DEELSA/ED/CERI/CD (2002)9. Paris. Available: www.oecd.org/dataoecd/47/61/35070367.pdf

———. 2004. *ICT, e-Business and SMEs*. France. Available: www.epol-net.org/pport/pdf/696370954.pdf

Pacific Islands Applied Geoscience Commission. Available: www.sopac.org/tiki/tiki-index.php

Pacific Islands Chapter of the Internet Society. Available: www.picisoc.org/tiki-index.php?page=WSIS

Pan-Pacific Education and Communication Experiments by Satellite (PEACESAT). Available: www.peacesat.hawaii.edu

Park, Eul Yong. 2002. *Building a Knowledge-based Economy: The Case of Korea*. Handong University.

PestNet website. Available: www.PestNet.org

Policy Strategies for a Knowledge-Based Economy in Thailand. 2002. Presented at the OECD-IPS Workshop on Promoting Knowledge-based Economies in Asia on 21–22 November in Singapore. Available: https://www.oecd.org/dataoecd/9/28/2482440.pdf

Prahalad, C.K. 2006. *The Fortune at the Bottom of the Pyramid: Eradicating Poverty through Profits*. Wharton School Publishing.

PRC Annual Book of Statistics 2005.

Prime Minister Lee Hsien Loong, *NewsWeek*. February 2006 Special Edition.

Prime Minister Matti Vanhanen. 2006. Competitiveness through Productivity. Speech delivered at the European Productivity Conference in Espoo, Finland, 30 August–1 September. Available: www.vnk.fi/ajankohtaista/puheet/puhe/en.jsp?toid=5307&c=0&moid=5308&oid=166093

Putnam, Robert. 2000. *Bowling Alone: the Collapse and Revival of American Community*. New York: Simon & Schuster.

Quah, Danny T. 1998. A Weightless Economy. *The UNESCO Courier*. December. Paris: United Nations Educational, Scientific and Cultural Organization (UNESCO). Available: www.unesco.org/courier/1998_12/uk/dossier/txt11.htm

Rao, Madanmohan. 2002. *The Asia-Pacific Internet Handbook, Episode IV: Emerging Powerhouses*. New Delhi: Tata McGraw Hill.

———. *Digital Review of Asia Pacific 2003–2004: India*. APDIP of UNDP, Pan Asia Networking Programme of IDRC, Orbicom, and Southbound.

Rychen, Dominique Simone and Laura Salganik, eds. 2001. *Defining and Selecting Key Competencies*. Kirkland, WA: Hogrefe and Huber.

Sachs, Jeffrey D. 2005. *The End of Poverty: Economic Possibilities for Our Time*. New York: Penguin Books.

Secretary of the Pacific Community. Regional Maritime Programme. Available: www.spc.int/maritime/index.php?option=com_content&task=view&id=14&Itemid=34

Secretary's Commission on Achieving Necessary Skills (SCANS). 1991. *What Work Requires of Schools. A SCANS Report for America 2000*. Washington, DC: US Department of Labor. Available: http://wdr.doleta.gov/SCANS/whatwork/whatwork.pdf

Solomon Islands Development Administration Planning Programme (SIDAPP). Available: www.peoplefirst.net.sb/general/about_us.htm

Stewart, Thomas A. 1997. *Intellectual Capital, the New Wealth of Organizations*. New York: Currency/Double Day.

Sveiby, Karl Erik. 1997. *The New Organizational Wealth, Managing and Measuring Knowledge-Based Assets*. San Francisco: Berrett-Koehler Publishers.

T. Yim-Teo. 2004. Reforming Curriculum for a Knowledge Economy, the Case of Technical Education in Singapore. Presented at the Education that Works: The NCIIA 8th Annual Meeting, 18–20 March in Nanyang Technological University, Singapore.

Talisayon, Serafin D. 2005. *What is Knowledge Management?* Parañaque City, Philippines: Center for Conscious Living Foundation.

———. 2006. *99 Paradigm Shifts for Survival in the Knowledge Economy, a Knowledge Management Reader.* Parañaque City, Philippines: Center for Conscious Living Foundation.

Thiruchelvam, S.K. and K.Z. Ahmad. 2005. The War for Brains: Attracting Scientific and Technical Talent to Malaysia. Forthcoming paper for Asialics, Republic of Korea. Available: www.asialics.org

Thuvasethakul, Chadamas and Thaweesak Koanantakool. 2002. National ICT Policy in Thailand. Africa-Asia Workshop. 25-29 March 2002, Kuala Lumpur and Penang, Malaysia.

Timmer, C. Peter. 2006. *How Countries Get Rich.* Center for Global Development. February. Available: www.cgdev.org/content/publications/detail/6238

Tsipouri, Lena, Anna Zygoura, and Vasilis Patsatzis. 2005. *Annual Innovation Policy Trends Report for Japan, China, Korea, Taiwan, Singapore, India, Malaysia, Thailand, Indonesia*. Enterprise Directorate-General, European Commission. Available: http://trendchart.cordis.lu/reports/documents/Country_Report_ASIA%20COUNTRIES_2005.pdf

UNESCO Bangkok. Palau. Available: www.unescobkk.org/index.php?id=1697

———. The Global Strategic Objectives and the Asia-Pacific Strategic Pillars. Available: www.unescobkk.org/index.php?id=465

United Nations Development Programme, GEF Small Grants Programme, and Equator Initiative. 2006. *Community Action to Conserve Biodiversity: Linking Biodiversity Conservation with Poverty Reduction.* March. Available: www.undp.org/sgp/download/biodiversity_case_studies_english.pdf

University of the South Pacific. Fiji. Available: www.usp.ac.fj/

Vaa, Ruby. Cook Islands: ICT Use in Education. In *UNESCO Meta-survey on the Use of Technologies in Education in Asia and the Pacific 2003–2004*. Asia-Pacific Regional Bureau for Education, UNESCO Bangkok. Available: www.unescobkk.org/fileadmin/user_upload/ict/Metasurvey/cookislands.pdf

———: Marshall Islands: ICT Use in Education. In *UNESCO Meta-survey on the Use of Technologies in Education in Asia and the Pacific 2003–2004*. Asia-Pacific Regional Bureau for Education, UNESCO Bangkok. Available: www.unescobkk.org/fileadmin/user_upload/ict/Metasurvey/marshallislands.pdf

Vickery, Graham. 2003. Policy Frameworks for the Knowledge-Based Economy: ICTS, Innovation and Human Resources. Paper presented at the Austrian Council International Workshop, Vienna, Austria, 10 July. Available: www.rat-fte.at/UserFiles/File/20030710_Vickery.pdf

Wallman, Commissioner Steven. 1996. The Future of Accounting and Financial Reporting, Part II: The Colorized Approach. *Accounting Horizons*, Vol. 10, No. 2, pp. 138–48. Available: www.sec.gov/news/speech/speecharchive/1996/spch079.txt

Weiping Wu. 2005. *Targeted Public Policies in Shanghai's Path to a Knowledge-based Economy*. In *Rethinking New International Order in East Asia: US, China and Taiwan*, edited by I. Yuan, pp. 227–251. Taipei,China: Institute of International Relations and Center for China Studies, National Chengdu University. Available: http://iir.nccu.edu.tw/chinapolitics/rethinking/07.doc

Wescott, Clay. 2005. *Promoting Knowledge Exchange through Diasporas*. Prepared for G-20 Workshop on Demographic Challenges and Migration, in Sydney, Australia, 27–28 August.

Wescott, Clay, and J. Brinkerhoff, eds. 2006. *Converting Migration Drains into Gains: Harnessing the resources of Overseas Professionals*. Manila: ADB. Available: www.adb.org/Documents/Books/Converting-Migration-Drains-Gains/Converting-Migration.pdf

Wikipedia. *Robert Metcalfe*. Available: http://en.wikipedia.org/wiki/Robert_Metcalfe

———. *Samoa: National ICT*. Available: http://wikieducator.org/Samoa/NationalICT

World Bank. 2003. *Lifelong Learning in the Global Knowledge Economy: Challenges for Developing Countries, A World Bank Report*. Washington, DC.

———. 2005. *The Knowledge Economy, the KAM Methodology and World Bank Operations.* Washington, DC. Available: http://siteresources.worldbank.org/WBI/Resources/The_Knowledge_Economy-FINAL.pdf

———. Various years. World Development Report. Washington, DC.

About Moving Toward Knowledge-Based Economies—Asian Exepriences

National economies are becoming more knowledge-based—economies where productivity and growth have become more dependent on knowledge. However, nations, organizations, and individuals did not intentionally design the "knowledge era," they were—knowingly or unknowingly—pushed into it. India and the People's Republic of China are moving to where knowledge has become the strategic national and organizational resource. The Asian economic landscape will continue to be pushed also by Japan and by smaller, but bright, economic performers such as Malaysia, Singapore, Republic of Korea, and Taipei,China. This publication aims (i) to examine the assumptions behind and ingredients of a knowledge-based economy and society and (ii) to survey how Asian governments have been planning to move their economies and societies to be more knowledge-based.

About the Asian Development Bank

ADB aims to improve the welfare of the people in the Asia and Pacific region, particularly the nearly 1.9 billion who live on less than $2 a day. Despite many success stories, the region remains home to two thirds of the world's poor. ADB is a multilateral development finance institution owned by 67 members, 48 from the region and 19 from other parts of the globe. ADB's vision is a region free of poverty. Its mission is to help its developing member countries reduce poverty and improve their quality of life.

ADB's main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance. ADB's annual lending volume is typically about $6 billion, with technical assistance usually totaling about $180 million a year.

ADB's headquarters is in Manila. It has 26 offices around the world and more than 2,000 employees from over 50 countries.

Asian Development Bank
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
www.adb.org
Publication Stock No. 091107

Printed in the Philippines