



# Knowledge transfer for sustainable development: East-West collaboration?

Amer Al-Roubaie

*College of Business and Finance, Ahlia University, Manama, Bahrain, and  
Shafiq Alvi*

*Concordia University, Montreal, Canada*

## Abstract

**Purpose** – The purpose of this paper is to discuss the potential impact that collaboration between East and West could have on sustainable development. Greater emphasis in this paper will be placed on the benefit that developing countries gain from building collaborative relations with the West. Obtaining access to knowledge and technology will enable developing countries to speed up the process of socio-economic transformation and sustain development. Developing countries can leapfrog by making use of the existing knowledge in the West.

**Design/methodology/approach** – This paper provides descriptive assessment of the relationship between East and West to foster growth and sustain development. The paper uses newly developed ideas to build capacity for knowledge transfer to create linkages and accelerate the process of economic growth. The approach to knowledge-based development requires the creation of an enabling environment driven by skills, innovation, institutions and ICT.

**Findings** – The paper suggests that knowledge transfer enables developing countries to sustain development. Access to global/western knowledge allows developing countries to diversify their economic structure and increase productivity. Technological learning and knowledge absorption permit these countries to leapfrog by surpassing several stages in their development.

**Practical implications** – Information in this paper provides insight into the merits of the new economy and the potential benefits that developing countries can obtain from participating in the global economy. Indigenous knowledge and local innovation are important for local development, which can be enhanced through technology transfer and knowledge dissemination.

**Originality/value** – Unlike traditional economic theories in which capital and labor provide the main inputs in production, this paper discusses a new approach to development where knowledge, skills and innovation represent the main forces behind growth. The paper explores new ideas to generate linkage and sustain development.

**Keywords** Education, Innovation, Sustainable development, Technology, Development, Knowledge, Globalization, East, West

**Paper type** Research paper

## Introduction

Today, we live in a world divided between a few rich and influential and a massive majority who are poor and lacking even basic needs for survival. Most of the poor live in developing countries representing large number of countries in Asia, Africa and Latin America. It is estimated that one quarter of humanity live on less than one dollar a day reflecting the extent of poverty and deprivation that millions of people experience daily worldwide. According to the Human Development Report 2013, the low human development group representing about 20 percent of world population generates about 3 percent of the global GDP, whereas the very high human development group accounting for 17 percent of the total world population accounts for 54 percent of the global GDP. Such a wide gap in the distribution of income and wealth represents failure



of the international economic system to provide appropriate mechanisms for equitably sharing resources among various worlds' regions. In addition, high dependency of the poor countries on rich nations for their financial, scientific, technological, educational, environmental, and food requirements has weakened the ability of the poor to diversify their economies away from a debilitating dependence on low-value-added exports. Global vulnerability and economic insecurity have worsened in recent decades because of rapid increase in population, urbanization, climate change and environmental degradation.

This aim of this paper is to discuss the economic potential that the new global economy provides to sustain development and accelerate the process of the socio-economic transformation in developing countries. The global economy facilitates greater access to international trade, financial markets, technology transfer and knowledge acquisition. Enhanced access along these lines offers potential to stimulate creativity and innovation in developing countries contributing to the building of productive capacity with a greater level of diversification in economic structure. In this context, codified knowledge could be used to create wealth and accelerate the process of balanced and sustained economic growth. However, responding to the challenges of globalization will require developing countries to strengthen the fundamentals for knowledge absorption, scientific application and technological learning. This paper sheds some light on initiatives of developing countries to increase global linkages and benefit from the new economy. Knowledge of the environment and technological learning are vital for fostering economic growth and sustainable development. The new economy offers wide range of choices for developing countries to diversify the economic structure and enhance productivity.

### **Sustainable development**

In recent decades, the concept of sustainable development has been widely debated as a long-term remedy to some of the serious challenges facing developing countries. Recent literature on development underscores the importance of the environment and the climate change to enhance productivity and sustain economic growth. Sustainable development aims to create a balance between the current use of society resources and future consumption to strengthen environmental management and support ecosystem. The most widely circulated definition of sustainable development is the one formulated by the Brundtland Commission as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987, p. 43) Thus, sustained growth entails countries to "attain basic thresholds on a number of fronts; sound economic governance, basic health care and education, core infrastructure, access to foreign markets" (United Nations, 2003, p. 67). The majority of developing countries rely on agricultural land to meet their food requirements and support sustainability. In this regard, policy intervention becomes essential for addressing the environment. As stated by the United Nations "Improving environmental management in ways that benefit poor people requires policy and institutional changes that cut across sectors and lie mostly outside the control of environmental institutions – including changes in governance, domestic economic and social policies and international and rich country policies" (United Nations, 2003, p. 126).

The environment and environmental variables must be integrated into developing country's national strategy to ensure that environmental changes do not derail sustainable development. Through knowledge transfer, the developing countries can

build capacity for environmentally friendly innovation systems stimulating a burgeoning of indigenous technologies contributing to productivity and linkage creation. In doing so, knowledge transfer empowers people to attain sustainable development by providing the know-how and skills needed for improving environmental management while fostering economic growth. Developing countries need to develop their own technology to support building capacity for sustainable development. Rich countries can make valuable contributions to sustainable development by sharing knowledge and opening access to technologies. These countries can help developing countries overcoming some of the obstacles to access to technology including lack of financing for investments in research and development; ambiguous intellectual property laws; limits of differential pricing; and national technology capacity, including local production capacity (see United Nations, 2003, p. 160). Sustainable development should enhance production and consumption in, and trade among, developing economies.

Sustainable development requires action be taken by national governments, international institutions, NGOs and civil societies to minimize environmental damage as well as to help poor nations acquire knowledge and information requisite for development. Six important policy principles which need to be taken into consideration for environmental sustainability feature prominently as follows:

- (1) strengthening institutions and governance;
- (2) making environmental sustainability part of all sector policies;
- (3) improving markets and removing environmentally damaging subsidies;
- (4) bolstering international mechanisms for environmental management;
- (5) investing in science and technology for the environment; and
- (6) increasing efforts to conserve critical ecosystems (United Nations, 2003, p. 127).

Knowledge of the environment is essential for sustaining development. Efficient environmental management requires greater knowledge about the environmental impact of production and consumption of natural resources including, but not limited to, the extraction technologies used. The developing countries must construct strategies for building adequate institutions, good knowledge of the environment, effective public awareness programs and database systems to monitor and update knowledge about the environment. Local knowledge alone is no longer sufficient for environmental management given the effects of cross-border negative externalities stemming from pollution and climate change. Developing countries must increase collaboration with multinational corporations, western countries and international institutions to enhance managerial capabilities with a view to mitigating the economic and social cost of environmental degradation. In addition, government should make efforts to increase the stock of environmental knowledge at home by increasing funding for education, research and development, innovation, information dissemination and ICT infrastructure.

Sustainable development requires appropriate technologies and new knowledge to bridge the present with the future through better management of resources, good governance and effective educational system to increase awareness and promote innovation. Knowledge for development involves building strategies that increase the capabilities of developing countries to acquire, absorb and communicate knowledge. Sustainable development requires the involvement of both public and private enterprises in decision making and market activities. Because of its social, economic and environmental

dimensions, sustainable development cannot be separated from human activities and, therefore, investment in education, health, innovation and environmental management becomes essential for fostering economic growth. In other words, increasing knowledge about the environment reduces the risk of environmental degradation and support rapid growth.

In recent decades, environmental and natural resource management have been acknowledged as important ingredients in the promotion of sustainable development. In developing countries, the immediate challenge is to meet basic needs, mainly food and other immediate services. In many of these countries, rural inhabitants still account for a large percentage of the total population reflecting the importance of agricultural resources and the natural environment in providing the necessary requirement to improve productivity and sustain people's lives. Sustainable development is about utilization of natural resources to create a balance between present and future consumption. Recent development trends have shown that climate change, mismanagement of natural resources and rapid population growth have impacted the prospects for rapid economic growth and sustaining development. The developing countries can make use of the knowledge and technology created in the West to build capacity for sustainable development. Modern ICT technologies and scientific knowledge in the West can be used in development to reduce the risk of natural disasters as well as to improve human resource management and increase productivity. ICT is a powerful enabler providing not only the public information on and awareness of the environment, but also access to global knowledge and information. In this age of global interdependence, access to knowledge, information, technology and skills can be easily obtained and utilized for local development. The advantage of building digital capacity is to provide access to global markets at low costs as well as increase the developing countries choices of scientific and technological selections.

Sustainable development mainly involves three important ingredients: the society, the economy and the natural environment. Similar to the construction of a knowledge-based economy, knowledge-based development entails the utilization of modern technologies to support building capacity for knowledge creation, innovation and human resource development. Stimulating linkages in the developing economy generates new productive activities. This can be done through technology transfer and joint venture with multinational corporations. In the case of Finland, for example, the restructuring the economy led to the diversification of the productive structure to embrace new technologies. In addition, increasing the share of total national expenditure on research and development stimulates innovation contributing to national output through the expansion and proliferation of linkages and new product development. To this end, the developing countries need a new model for development that take advantage of the new opportunities offered by globalization. No longer are traditional industries typically involving production of primary products sufficient for endorsing rapid transformation and sustaining development. Rather, knowledge, science and technology, research and development, innovation, market freedom, and human capital resources power development. Building productive strategies for development should involve all sectors of society to support entrepreneurs, small business, enterprises and other productive agents to participate in the process of development.

### **Knowledge for development**

During the last two centuries, economic growth among nations has been induced by scientific advancement, innovation, industrialization and technological learning.

Uneven distribution of capacity to engage in development of science and technology has not only widened income inequalities among nations, but also increased western economic dominance over the international trading system. Rapid scientific and technological advancement served to increase labor productivity in western countries causing real income per capita to multiply several times over the past several decades. Industrial development and manufacturing production added substantial value to total output produced in these countries reflecting the economic success achieved by western economies. As for the developing countries, instead of tapping into western scientific and technological progress to develop indigenous industry, they remained dependent on western manufactured and industrial products as consumers (see World Bank, 1998, 1999). Currently, the share of high income exports accounts for more than two-thirds of the total world exports comprising mainly knowledge-intensive and high-tech and manufactured products. Primary products and export of raw materials can no longer provide consistent economic growth and sustain development. Global integration and access to global markets mandate that countries acquire knowledge and enhance innovation. In this age of globalization, trade and FDI facilitates knowledge acquisition and technology transfer via activities of multinational corporations (see Harhara and Al-Roubaie, 2014).

In the new economy, knowledge, skills and innovation are key inputs in the production function. Unlike traditional economies in which capital and natural resources represent key drivers of economic growth, the new economy entails building knowledge and innovation capabilities with a view to enhancing productivity and generating linkages. Unfortunately, most developing countries still lack essential components for knowledge creation, technology diffusion and information dissemination. Though globalization has provided new opportunities for developing countries, the current challenges facing these countries including, political, financial, social, environmental and economic factors, have impeded development by reducing the ability of developing countries to speed up the process of change and take advantage of globalization. Knowledge creation requires building capacity in the context of human resource management, institutional functionality, innovation system, ICT infrastructure and political leadership to make sound decisions and construct appropriate macroeconomic policies (see Al-Roubaie, 2013).

Economic development is a process of structural change which requires both external and internal initiative to diversify the economic structure and create linkages. In this age of global interdependence, access to knowledge, information, skills and technology has become much easier through international trade, multinational corporations, bilateral and multilateral agreements and joint programs. For their part, the developing countries need to meet the challenges of globalization by building capacity to facilitate knowledge acquisition, information dissemination, scientific application and technological learning. This enhances the ability of these countries to innovate and create appropriate technology suitable for local development. As a global good, knowledge can be acquired through trade linkages and also through cooperation with western firms. At this stage, most developing countries are not yet ready to create their own knowledge and, therefore, it is incumbent upon them to make use of the knowledge available in the rest of the world. They should explore new channels to absorb global knowledge and acquire foreign technologies to strengthen their development capabilities and stimulate economic growth.

Increasing cooperation with the West provides developing countries new opportunities to expand market activities and gain access to western knowledge and technology utile for developing countries still lack adequate capacity to generate,

completely independently, indigenous knowledge and technology (see Al-Roubaie, 2006). A large share of contemporary global trade flows involves knowledge-intensive goods and services. However, the developing countries are largely unqualified (with the notable exception of the PRC and South Korea) to produce and gain market share in high-value-added global trade. In the main, however, transformation of developing countries to participate in the new economy on a level playing field requires “changing the rules that underpin global relationships.”

An important feature of development in this age of global interdependence is to strengthen the capabilities of local enterprises and entrepreneurs to gain access to global markets. In the early stages of their development, developing countries should encourage joint venture with global firms to enhance linkages and diversify the economic structure. Future trends show the need for creative industries driven by knowledge creation and innovation (see Al-Roubaie, 2010).

Developing countries need to formulate and execute well defined strategies in order to face the challenges of the new economy involving the building of knowledge capacity for development. These countries need to create enabling environments that encourage lifelong learning, enhance human capital resources, promote innovation, ensure political stability, construct effective macroeconomic policies, support research and development and increase global access to knowledge, information and technology. In addition, these countries need to have strong leadership with clear vision of the future involving increasing public participation and encouraging private enterprise to innovate using, above all, tacit knowledge.

Innovation ranks among the important drivers of development. Digital technologies driven by the use of ICT empower both individuals and small and medium enterprises (SMEs) with the know-how to acquire scientific knowledge and to cultivate other skills requisite for development. Innovation creates linkages and strengthens the fundamentals for capacity building which, in turn, stimulate value-added manufacturing and industrial efficiency and competitiveness. Substantial tacit knowledge, which can be tapped to increase productivity and create new market opportunities for development, proliferates in developing countries. Nevertheless, developing countries need to acquire knowledge and skills beyond the existing well-spring of tacit knowledge in synergy with the exploitation of this local knowledge. As a global good, knowledge has become accessible to all those willing to leapfrog and accelerate the process of development through building ICT infrastructure capable of transferring technology and sharing information. However, on the one hand, global knowledge is a proverbial “double-edged sword” – mishandling can result in injury especially in the hands of neophytes. On the other hand, premature knowledge creation, eschewing input of global knowledge, entails costs and risks for developing countries, and, therefore, the developing countries need not to invest in creating knowledge of their own. In the short- and medium-run, they are better advised to adopt and adapt existing global knowledge, produced mainly in western countries, to support building capacity for development. The existing conditions for promoting development through knowledge creation are not favorable given the combined effects of: low level of education and training, inadequate institutions, lack of research and development and poor financing.

### **Digital technology**

Access to digital technologies represents one of the biggest challenges facing the developing countries to enhance e-readiness and increase global participation. E-readiness involves

building digital infrastructure to empower the economy with new technologies conducive to sharing knowledge, conducting commercial activities (B2B, and to a lesser extent, B2C), providing public services and improving communication. The rise of the internet has brought substantial increases and shifts in economic activities as phenomena identified with globalization. Currently, the digital gap between the developed and developing countries is widening weakening the ability of the these countries to gain access to global knowledge for development. Education, health, skills, information, ideas, science and technology are among the important features of modern development which can be improved with the use of digital technologies. In addition, digital technologies increase access to world markets. Such access broadens the choices that inhabitants of developing countries have to acquire knowledge, obtain skills and, in turn, gain competitiveness. In other words, digital technologies improve human development by facilitating sharing of knowledge. Economic development can proceed only where developing countries, after having acquired requisite knowledge, gain access to the market, on a level playing field, with developed countries. Increasing digital connectivity accelerates development.

In the new economy, building digital “superhighways” provides infrastructure necessary for innovation (just as in the old economy roads and bridges were necessary for the distribution of goods). Among developing countries, innovation is still inadequate to create sustainable solutions to empower development. Where low levels of innovation are attributable to tepid entrepreneurial activity, however, the expedient of micro-finance has proven salutary. For example, Grameen’s experiment in Bangladesh helped millions of poor people start businesses and participates in market activities. Providing small loans, mainly for women, have broadening market activities through communication and access to other villages and cities. In Bangladesh, on the one hand, the level of entrepreneurial activity ratchet up though micro-finance generating income for the poor by spreading economic benefits to a large number of people. On the other hand, innovations have not been generated commensurate with the leap in entrepreneurial activity in large measure because the Grameen experiment did not plug into digital technologies. Entrepreneurial use of digital technologies could have generated substantial innovation.

Availability of finance, unto itself in isolation, cannot generate innovation. For example, the Gulf governments possess the financial resources to invest in science and technology, and, as in the case of Saudi Arabia with the building of so-called industrial cities have attempted to do so, but due to the inadequacy of human capital resources and the inability to attract foreign human capital to plug the domestic gap, have failed to achieve little more than invest inefficiently in real estate. Financial capital surplus cannot compensate for human capital deficit and thus the prospect to build productive capacity for development will be subject to constraints. In this context, South-South cooperation has merit were, for instance, Gulf financial resources to be channeled into economies that have substantial human capital but lack commensurate financial capital (Malaysia, India). With scientific and technical know-how, at a later date, repatriated to Gulf country of financial origin – both sides in the South-South exchange would benefit. The adaption of this scientific and technical know-how from, say, India (as a source of human capital) to Kuwait (as a source of financial capital) would be easier than the same from the UK to Kuwait inasmuch as the developing countries share several factors in common, including environmental, educational, cultural, social and developmental features which can be cultivated to increase cross-border linkages and share knowledge within the South.

In the new society, digital literacy is critical for rapid economic transformation. It increases the ability of the economy to harness tacit knowledge as well as it enhances the capabilities to improve productivity in production, distribution and consumption of goods and services. Digital literacy is the familiarity of people with the use and operation of computers to gain access to the internet, e-mail and web browsers. Networking is an integral part of modern business providing access to knowledge, skills, information, technology and market data. ICT strengthens e-readiness and increases public participation in development through digital literacy and access to global business. In this regard, ICT is a powerful enabler that can cut costs, facilitate commercial exchange and provision of governmental services. E-readiness requires countries to invest in human resources in order to build up the store of human capital in an economy with a view to increasing productivity. By equipping labor with knowledge and skills, the potential for linkage creation and innovation is buoyed.

Developing countries can reduce the digital gap and speed up the process of economic growth by acquiring global knowledge, absorbing knowledge and communicating knowledge through ICT. Knowledge acquisition underlies an economy's capability to strengthen the local knowledge system, conduct research and development, improve education and skills and promote innovation. Change must come from within by encouraging local enterprises to make use of the indigenous resources and exploit tacit knowledge for development. In other words, building capacity for indigenous knowledge is essential for inducing innovation and accelerating economic growth. It empowers the economy by generating linkages and diversifying the productive structure. In other words, choices of indigenous knowledge need to be widened by building capacity for knowledge absorption and technology transfer.

Building knowledge capacity through technology transfer and knowledge absorption will strengthen the local knowledge system for supporting development. Given the state of underdevelopment, it will be easier for developing countries to narrow the digital divide and accelerate the process of economic transformation through the adaptation, absorption and diffusion of knowledge and technologies that already exist elsewhere. In addition, collaboration with international firms increases the potential for linkage creation and promotes global competition. Linkages stimulate development through the establishment of new industries which depend largely on resources drawn from the local market. For example, Malaysia in the 1990s benefited from the chain of industries which were required to support the computer industry.

The developing countries should seize upon the opportunities afforded by globalization to strengthen digital services and build effective communication systems capable of generating efficiencies in commercial exchanges. Provision of e-services by the government are crucial for development. Knowledge-based development entails knowledge sharing among various economic agents which empower an economy's capability to increase linkages and diversify its economic structure. Building digital capacity strengthens communication and enhances access to knowledge and information throughout the economy. Developing countries must overcome the barriers to participation in the new economy as full partners of developed economies by constructing policies that synergistically exploit both indigenous and global knowledge. In this respect, the government must intervene by promoting the building of digital infrastructure capable of providing the necessary antecedents for transforming the economy into a knowledge-based economy including: education, health, skills, information and communication – collectively stimulating investment and encouraging knowledge sharing.



Development is about bringing together all productive agents including leaders, educators, businesses, government and other groups in society to work together in line with a strategic vision for development. Digital technologies facilitate the implementation of such vision by providing the means for communication and improving the ability of the economy to absorb and communicate knowledge. Digital technologies are increasing the speed of doing business and decreasing the cost of services needed for development. In addition, these technologies facilitate research and increase the economy's potential to become creative and innovative. "ICT and related tools also enhance the quality of products, production and delivery processes, inventory management, and labor productivity – all these are 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 boarder partnership among players in supply- and –production chains possible" (Asian Development Bank, 2007, pp. 18-19).

As a powerful enablers, digital technologies could help in reducing poverty, enhancing productivity, narrowing income inequalities and inducing rapid economic growth. In the knowledge-based economy, businesses benefit from linkage creation by various firms and therefore, they need to access to outside partners to acquire assets and information in production, marketing and distribution. Collaboration with foreign firms is important for acquiring knowledge and competencies to stimulate linkage creation and accelerate development. To this end, multinational corporations increase the ability of local firms to benefit from market expansion and spillover effects brought by foreign firms activities in the local economy. Foreign direct investment supports both demand- and supply-side activities generated in the process a wide range of forward and backward linkages which enhance productivity and stimulate economic growth. Building digital capacity provides local industry and domestic enterprises with the necessary tools for sharing knowledge and exchange information.

Dissemination of modern knowledge requires building digital capacity to facilitate access to knowledge and information for building capacity for development. The utilization and use of ICT is essential for sharing, capturing and communicating data and information. In addition, It stimulates innovation capabilities which creates linkages and diversify the productive structure. Human activities involve information processing and sharing which can be enhanced with the use of ICT.

Enhancing digital technology diffusion increases an economy's capability to innovate as well as to upgrade human capital. In other words, knowledge transfer plays an important role in supporting the local knowledge system to increase the use of knowledge. Currently, developing countries suffer from the digital divide symptomatic of inadequate access to the internet, computers, digital cables and, to a much lesser extent, mobile networks. Accordingly, large numbers of people in developing countries cannot afforded costs entailed with the acquisition of digital services notwithstanding the proliferation of cheap mobile phones in many developing countries i.e. access to the internet from these devices is often infeasible or expensive. In consequence, reducing the digital divide requires government intervention including promotion of foreign direct investment in digital infrastructure to build ICT infrastructure and provide easy and cheap access to information and knowledge. Once the digital divide is narrowed, expanding trade, transfer of technology, skill acquisition, knowledge absorption and information dissemination – all necessary for transformation to a new economy – will accelerate. Unfortunately, e-readiness in most developing countries is inadequate to support rapid transformation into a knowledge-based economy.

### **Knowledge-based development**

Knowledge-based development can be defined as a process of structural changes that involve the application of knowledge in various economic activities. Building a model for development entails both local and external elements aimed at accelerating the process of change and leapfrogging. Adaptation to the new economy requires restructuring the socio-economic order and reengineering the productive structure to absorb knowledge and information in order to strengthen the innovation capacity of the economy and enhance knowledge creation. Engaging in international trade allows countries to acquire technology and gain access to scientific knowledge. However, countries must meet certain standards in production for the global markets only attainable through improving technological learning and introducing new technologies. Innovation occurs when new methods or new technologies are introduced into the economy. There is substantial tacit knowledge stored in the mind of people in developing countries which needs to be exploited to support not only innovation but also creativity and knowledge creation (see Ahmad and Al-Roubaie, 2012).

Building capacity for knowledge-based development rests on important pillars including a well- trained and competent workforce; a national innovation system backed by research and development, science and technology and a dynamic culture; building ICT infrastructure to facilitate social networking and strengthen communication; and an efficient institutional regime capable of providing the incentive and support for economic agents. The involvement of the government is essential for supporting the creation of enabling environment that encourages innovation and technology diffusion requisite for leapfrogging and strengthening the economic basis for rapid balanced and sustained growth.

The human factor is instrumental in building capacity for development. Developing countries can benefit from the experience of Singapore and South Korea, on the one hand, and New Zealand and Finland and other developed countries, on the other, to enhance quality of education and improved the skills of the workforce. Through collaboration with institutions in the West, the potential exists for developing countries to gain experience in conducting productive research for building an indigenous knowledge-base. Technological learning is essential for technology transfer and upgrading to suit local conditions. Close collaboration with universities, institutions, industries and research centers located in western countries provides new opportunities for developing countries to increase access to knowledge, information and skills for development. Knowledge can be acquired and adapted to the local environment through the active involvement of foreign firms operating in developing countries. Similarly, engaging in the international trading system and participation in international symposiums allow developing countries to obtain know-how and competencies for development.

### **Science and technology**

The other important dimension of western contribution to promote innovation and sustainable development is through science and technology. Western scientific application and technological advancement allow developing countries to overcome serious impediments impeding the achievement of rapid growth through increased productivity. As pointed out by the World Bank “if developing countries hope to prosper in the global economy, and if world leaders expect globalization to foster sustainable development and sustainable poverty reduction, STI capacity building is

an absolute necessity. In today's rapidly changing global economy, the critical economic development issue is no longer whether countries should build STI capacity but what type of capacity to build and how to build it, given each country's economic constraints and starting point" (Watkins and Michael, 2008, pp. 1-2). In this respect, developing countries must construct strategies for technological development suitable for their own economies. This policy must involve broad-based participants including entrepreneurs, policy makers, business people and young people to ensure that STI will contribute to productivity growth. Science and technology could help in producing knowledge and enhance technological learning to strengthen innovation and build linkages within various sectors of the economy. Although developing countries are described as "latecomers," however, these countries can close the gap "if they learn how to convert their latecomer status into an advantage." These countries could speed up the process to leapfrog by "building the domestic capacity to find existing technologies, adapt them for local use, and incorporate them into the production process" (Watkins and Michael, 2008, p. 4).

Developing countries should take the initiative to increase access to science and technology through FDI, joint venture, collaboration and international trade. In this respect, research and development is essential for identifying technological requirements suitable for the local environment. Universities and educational institutions could play an important role in the determination of scientific and technological desiderata to meet development requirements for balanced and sustained development. In the long-run, expanding the capacity to absorb knowledge and diffuse technology will help the country to produce new knowledge and create a new climate for innovation. "Innovation more frequently entails building the capacity to use technologies that are in widespread use elsewhere but that are new to the country, new to the firm, or used in new ways" (Watkins and Michael, 2008, p. 7). If the right technology is found, the ability of the country to innovate will be enhanced through the development of new products, new technologies and new methods. The state could play constructive role by investing in people to increase the skills and basic literacy needed to support scientific application and technological learning. In addition, In developing countries, women are directly and indirectly involved in development and, therefore, government policy should give women equal opportunity to participate in the economy by encouraging women to go into science and technology.

Inadequacies with respect to the "creation and application of science, technology and innovation in development" (United Nations, 2005, p. 2) is one of the important impediments in development. Developing countries suffer from shortages of human resources capable of conducting scientific research and adapting modern technology to support innovation and exploit creativity. Modern science and technology is at the heart of development and, therefore, developing countries need to construct strategies to improve the absorption of foreign technology and science in development. Technology positively impacts the economy by increasing the utilization of factor inputs in production and reducing the costs of doing business. In this regard, the developing countries must invest in education and training to build scientific and technological human capital and infrastructure.

Universities in particular and higher education institutions in particular empower the economy with knowledge and skills needed to diversify the economic structure and increase access to global knowledge and information. Countries with highly trained workforces will have advantage in acquiring global knowledge and get the maximum value from recent advancement in scientific and technological development employed

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by multinational corporations. Technological diversification allows countries to create linkages and develop new products and services which accelerate the process of transformation and enhance economic growth. However, a strategy for catch-up needs to “focus on the building of an endogenous knowledge base, but also facilitate the transfer and effective absorption of foreign technology [...]”. The design of policies aimed at upgrading technological capabilities in LDCs should not ignore but develop the potential offered by existing local innovation and integrate it with transferred technologies” (United Nations, 2007, p. IV).

The institutional weakness in the developing countries discourages the building of productive capabilities to support knowledge diffusion and technological dissemination. Effective institutions are the *sine qua non* to meet the challenges facing developing countries. For example, in most developing countries market institutions are sidelined in development by an overweening public sector exacerbated by a lack of public participation by local entrepreneurs. Japan, Singapore, Finland and South Korea have been able to strengthen knowledge creation, technology diffusion and innovation through the creation of productive institutions that participated in speeding up the process of transformation. Local enterprises need support to increase access to global opportunities and obtain knowledge, skills, technology, finance and information. In addition, the financial system is important for promoting business and supporting young entrepreneurs; however, most developing countries lack not only access to microcredit facilities, but also suffer from inefficient or mal-functioning financial institutions and markets. SMEs cannot compete for funding because most commercial banks prefer to lend credit to large corporations. In Japan, approximately 99.5 percent of the gross domestic output is produced by SMEs reflecting the creative and productive capabilities of these enterprises as well as their involvement in one of the most powerful economies in the world. In the case of South Korea, considerable support was given to education and innovation which provided SMEs the wherewithal to become innovative and creative. To this end, developing countries must embark on radical reforms with a view to building productive capacity driven by linkage creation, knowledge acquisition and technological learning.

Developing countries need to build capacity to gain access to the existing knowledge in the global economy and also to enable them adapting western technology in development. In this regard, building capacity increases incentives for foreign firms to invest in the local economy. Technological adaptation through international trade helps access to international skills and knowledge as well as enhances the ability to learn and master foreign technology. In addition, creating linkages through exports with foreign firms and customers strengthen technological learning to diffuse foreign technology through these linkages. For example, FDI helps domestic firms upgrading their technological skills to diffuse new technologies leading to productivity improvement among all sectors of the economy. Technological development and scientific advancement in developing countries can be improved through upgrading technology that already exists in advanced countries. Such learning allows developing countries to acquire skills and competencies to promote innovation, create linkages, diversify the productive structure and create new knowledge.

## Conclusion

During the past two decades, developing countries have been given greater opportunities to gain access to global markets acquiring skills, knowledge, information and technology. The new economy, driven by globalization, is described as an economy

in which knowledge is a key driver. For countries with limited natural resources and inadequate skills, the new global economy provides easy access to science and technology which, in turn, enhance a country's capabilities to diversify the economic structure, encourage innovation and promote balanced and sustained economic growth. However, very few developing countries have succeeded in joining the ranks of equal participants in the new economy. In large measure, this delinquency is attributable to developing countries' not having created an enabling environment to facilitate knowledge absorption, technology transfer, human skills, research and development and innovation.

To do so, not only is cooperation with the West important, especially in the context of technology transfer, but, equally, South-South cooperation is vital given that although developing countries have limited capacity to acquire and diffuse science and technology, some have a greater capacity than others to do so. In the South, arrangements in which financial resources are allocated into countries with comparably greater capacity hold prospect for future intra-South technology transfer that, in the long-run, hold out prospect for both donor and receiver of financial capital to enter the ranks of countries boasting new economies. The challenges facing many developing countries today involve the construction of strategies based on policies, on a domestic and South-South level, to strengthen capabilities to absorb, use and create knowledge. In the digital age, knowledge and information represent key drivers of economic growth and sustaining development. The new economy offers new opportunities to developing countries by providing easy access to global knowledge and information. Countries with less limited financial resources but inadequate human capital could benefit from countries with limited human capital but inadequate financial resources – and vice versa – not only from increasing trade, but also from access to knowledge, information and skills to compensate for shortages at home. Imbuing developing countries with knowledge-based economies, in the short-run, requires cooperation with western countries but, in the long-run, would be spurred by South-South cooperation as a means to encourage creativity and induce innovation through, eventually, the production of intra-South indigenous technologies.

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### About the authors

Dr Amer Al-Roubaie is currently the Dean of the College of Business and Finance, Ahlia University, Bahrain. He holds PhD in Economics from the Montreal. His research publications include books, research papers and many articles published in international journals. Dr Amer Al-Roubaie is the corresponding author and can be contacted at: [aalroubaie@ahlia.edu.bh](mailto:aalroubaie@ahlia.edu.bh)

Dr Shafiq Alvi is a Professor Emeritus of Economics at the Concordia University in Montreal. He has published several books and a number of research articles in international journals.