Technology Transfer and Sustainable Development in the Gulf Region
A Global Perspective

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INTRODUCTION

During the last two decades, economic globalization has increased world's trade, finance, capital flows and labour mobility to levels never experienced before. In addition, rapid improvement in information and telecommunication technologies has increased interdependencies and interconnections among people and nations by speeding up international transactions and enhancing business contacts. Similarly, cost reduction in transportation and telecommunication has broadened global competition by creating new opportunities for countries to compete in world markets. However, to deepen globalization, countries are to undergo political reforms, deregulate trade, liberalize financial institutions, and privatize the domestic economy. Undertaking such steps are necessary for facilitating the flow of capital, transfer of technology and access to global business. Globalization increases specialization in production by enhancing the process of comparative advantage which allows countries to make better use of their resource endowments and cheap labour costs in production and export. All members of the GCC are oil producing and exporting countries. Because of their control over cheap and large oil deposits, these countries are in a comparative advantage position to make use of globalization and speed up the process of economic growth. Such economic gains could be easily cultivated through the transfer of technology, construction of sound macroeconomic policies, effective economic management, regional coordination, efficient planning, and increasing the stock of human capital. In recent years, rapid economic growth in some Asian countries including Singapore, Taiwan, and Malaysia has shown that good economic management, sound macroeconomic policies and adequate capacity building are vital for enhancing the process of growth and sustaining development (World Bank, 1993). At present, the Gulf countries are making efforts to restructure their economies and reengineer development by exploiting the new knowledge-based economy and deepening integration in the global markets.

Technical progress and scientific applications have been the driving force behind changes in productivity and industrialization in industrialized countries. Thus building a viable infrastructure to harness the benefit of technology should be placed at the top of the economic agenda in Gulf countries. Due to small size of their markets and because of low industrial development, individual countries may not be able to set up adequate institutional and scientific foundation for technological advancement. Cooperation among member states becomes necessary for creating a greater potential to exploit scientific applications and promote technological development. Although technology transfer is not always appropriate for sustainable development, it is nevertheless an important step for generating linkages and broadening the economic structure. Thus, a collective approach aiming at pooling resources together enhances the capability of Gulf countries to speed up the process of technology absorption. To this end, an integrated policy plan needs to be constructed for linking both public and private institutions in order to create domestic capacity for technology. This 'bottom-up approach' enhances the region's capacity to build divers channels for scientific and technological development. Sustainable development will be enhanced by building adequate channels for monitoring, supervising and allocating resources among all countries of the region.

This paper highlights the importance of technology transfer and its impact on sustainable development in Gulf countries. The paper argues that technology transfer increases economic growth by allowing greater access to globalization. Furthermore, foreign technology could contribute to the creation of indigenous methods which are suitable for meeting the environmental, social, cultural, economic and geographical features of the Arab region. Ultimately, indigenous technology leads to sustaining development by bridging the time gap between present and future generations. This by no mean easy to be accomplished, but in making sound macroeconomic policies, building strong institutions, developing adequate skills, formulating effective planning and undertaking steps to increase public participation, these countries could bridge the technological gap and sustain growth.

CHALLENGES OF GLOBALIZATION

During the last two decades, the emergence of globalization has brought substantial changes in world trade, finance, communication, capital flows, labour movement, and technology transfer. Although globalization is vaguely defined, its impact on world's societies is viewed to be sweeping. As a multidimensional concept, globalization consists of social, cultural, economic, political, scientific, environmental and technological components that influence human relations, weaken national sovereignty, and increase global interdependencies. The new economy driven by globalization is a knowledge-based economy which requires investment in human capital, technology transfer, and research and development. Unfortunately, both income and knowledge gaps are widening between industrialized and non-industrialized countries reflecting the financial and economic constraints which are facing many of the developing countries in meeting the challenges of globalization (Al-Roubaie, 2002).

Globalization has reduced the cost of growth by allowing greater access to markets, finance, trade and scientific and technological methods which are needed for increasing productivity and promoting development. However, harnessing the benefit of the new knowledge-based economy will depend on the country's capability to utilize the new techniques for improving the country's comparative advantage and enhancing indigenous growth. Technology becomes more effective if it is harmonized within the domestic economy through the creation of a healthy environment to absorb knowledge. As an effective means for creating and adapting technology, education must be given a high priority in overall decisions made by GCC countries (Mowlana, 2001).

Economic development is a process of multidimensional changes involving social, environmental, technical, political, scientific, institutional, educational and economic factors. The Gulf countries have their own distinguished geographical and cultural features which must be taken into consideration if development has to be successful. Knowledge, information and technology are useful for development of indigenous commodities as well as for promoting import substitution to increase the region's ability to compete in global markets. The new economy is about creating new ideas and innovating new techniques which allow countries not only to produce goods and services, but also to diversify the economic base of the local economy.

Global linkages induce socio-economic change by providing greater access to knowledge and information which are needed to expand the productive capacity and sustain development. An effective policy direction must endorse change to enable countries cultivating both local and global linkages. To do so, the Gulf countries may need to review some of the challenges facing the Arab region and mentioned by the United Nations on the statues of Arab human development. The United Nations sums up the challenges facing Arab countries to overcome the developmental problem in the following way: "(a) deal with structural problems and technological change; (b) meet the challenges of globalization and economic openness and (c) generate effective collective action to face new developments and the challenges they pose to governments, businesses, investors, workers, political parties and institutions." (UN, 2002, p. 121).

SUSTAINABLE DEVELOPMENT

The economies of most countries in the Gulf are relatively small. With the exception of oil and gas resources, these countries are not fully equipped with an adequate natural resource base for building viable agricultural and industrial sectors. On one hand, agricultural production is constrained by water scarcity and the availability of fertile land. On the other hand, industrialization depends on labour supply and technological advancement. At present, almost three quarters of the labour force employed in GCC countries is imported from outside the region. Industrial production requires a quality labour, which is capable to meet not only the industrial requirements but also the environmental and social factors prevailing in the region (Al-Roubaie, 2005). To plan for future development, these countries need to implement policies and introduce technologies aiming at reducing dependency and improving economic management. Sustaining development provides an alternative approach to achieve such objectives but not without introducing major reforms capable of restructuring the economy and to paving the way for greater self-reliance (Harris and et al. 2001).

In recent literature on economic development, the concept of sustainable development has been widely debated. Its main objective is to allow countries balancing development via meeting present needs without jeopardizing the ability of future generations meeting their own needs. Sustainable development not only involves capacity building and institutional reforms but also induces greater harmonization among economic, social, cultural and environmental forces. In this age of globalization, sustaining development requires adapting policies and programs aiming at making tangible progress on a wide range of issues while maintaining their drive to deepen integration in the global markets. Globalization induces industrial production creating in the process environmental costs which burden developing countries. In consequence, these countries need to improve economic management, enhance supervision, increase coordination and invest in the development of cleaner and more appropriate technology capable of protecting the environment and sustaining growth. Recent experience with growth based on Western models and technologies has failed to promote development in Third World countries. The concern over industrial pollution, global warming, deforestation, land degradation and water scarcity promoted policy makers, international institutions and national governments to call for alternative methods aiming at increasing productivity within the context of the complex interrelationships brought by global interdependencies and competitiveness. The warning of the Club of Rome in its popular report The Limit to Growth published in 1972 sparked a major debate about the dire consequences of unlimited abuse of natural resources (Meadows and Randers, 1972). The report highlighted the need for higher economic growth to be checked against environmental protection. The call for environmental protection was further endorsed at a number of international conferences sponsored by national governments and international institutions including the Stockholm Conference on the Human environment (1972) which later resulted in the establishment of the United Nations Environment Programme (UNEP) and the United Nations Conference on Environment and Development (UNCED), also known the "Earth Summit", held in Rio de Janeiro, Brazil 1992 (UNCED, 1992; World Bank, 1992).

Sustainable development is defined by the United Nations Environment Programme in a widely quote report known as the "Brundtland Report" as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs… In essence, sustainable development is a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations…" (UN, 1987, p. 46). In this broad definition, the United Nations highlight the importance of sustainable development by emphasizing the management of resources, investment and technology for linking present with the future. No doubt that technology is a determining factor in sustaining development. However, technology itself must be an integral element of the national strategy to sustain change. Most of the present technology used in Gulf countries is imported with very little

efforts being made to improve regional production of new methods and appropriate techniques to meet regional economic sustainability.

Sustainable development underlines the importance of management of resources to increase their productivity aiming at supporting continuous growth to meet future generations need. As a program for change, sustainable development is not limited to increasing linkages between the present and the future, but also involves improving the quality of life and increasing man's ability to participate in the process (Al-Roubaie, 2003). Modern technologies including electronic computers, the internet and satellite broadcastings have increased global linkages by allowing countries greater access to information and knowledge. The Gulf countries can benefit from recent advancement in telecommunication technologies to build support systems aiming at sustaining development through the establishment of high-tech small scale industries. The global price paid for oil and gas may not necessarily reflect the environmental damage in these countries to endorse future sustainability. In Arab countries, the annual population growth is 2.7, or among the highest in the world. Furthermore, urban population is estimated to represent about 60 present of the total population in these countries by the year 2015 (United Nations, 2004). Therefore, there is urgency for the construction of a well-defined strategy capable of restructuring the economies of the region to increase the creation of job opportunities, enhance productivity, improve services, protect the environment and sustain growth. Globalization is rapidly transforming societies by introducing different educational, managerial, organizational, financial, technological and cultural products, which require radical economic restructuring and heavy investment in human capital. The two recent Arab Human Development Reports published by the United Nations Development Programme in 2002 and 2003 have presented a critical assessment of the socio-economic condition in Arab countries. The conclusion of these reports blames the Arabs for not doing enough to meet the challenges of globalization by failing to enhance the knowledge-based structure of their economies. Education and skills development represent another sticky issue that need to be confronted if these countries have to sustain development in the immediate future. More than two thirds of the labour market in these countries is made of imported labour. One must also keep in mind that the resources presently used in most Gulf countries are nonrenewable implying that they have a time limit for their use. Technology transfer could prolong the lifespan of these resources through diversification and manufacturing of raw materials in order to improve value added and enhance sustainability. Industrialization through technology transfer could produce undesirable environmental impact damaging in the process agricultural production, inducing labour movement, polluting water and air and changing the physical landscape. Therefore, an industrial strategy must be designed within the framework of the national plan by becoming an integral part of the overall development. To sustain change through technology transfer, there must be mutual linkage between various sectors in order to sustain development.

TECHNOLOGY TRANSFER

Technology is a determining factor in production possibilities of every nation. It enhances the nation's capabilities to produce goods and services by reducing costs and increasing efficiency. Historically, technical progress has been the driving force behind development in industrialized countries. Rapid endogenous growth was made possible through higher investment accumulation, research and development and the building of a larger stock of human capital. Economic development involves process of structural transformation aiming at organizing production, diversifying the economic base and increasing economic growth. As a tool of economic development, technology incorporates the nation's human and physical resources, which enhance indigenous knowledge and increase productivity of the economy (Cypher and Dietz, 1997).

In recent years, technological diffusion through global linkages has accelerated productivity changes in many developing countries. For example, the newly industrialized countries in Asia have been able to generate stimulus through the activities of transnational corporations and capital flows.

Acquisition of technology usually promotes industrialization and increases the country's export capability. In this respect, technology transfer becomes a desirable condition for harnessing global knowledge and increasing total factor productivity. However, industrialization must involve making choices in order to reduce the social cost by preserving the nation's environment and balancing benefits between present and future generations. Endorsing such policy implies that the state must assume a greater role in deciding the appropriateness of technology to ensure environmental protection and sustainable development. Knowledge for environmental management is linked to the use of technology through the creation of institutions capable of gathering and disseminating information, improving public understanding, conducting scientific research and strengthening environmental control.

In this age of globalization, deepening global integration and increasing competitiveness involves the acquisition of modern techniques to assist in promoting linkages between local and global markets. In addition, access to information especially the Internet is useful for increasing communication and sharing responsibilities among communities and state governments. Despite their financial capability, the Gulf countries are not yet fully prepared to cultivate the knowledge-based economy because of low productivity, inadequate skill requirements, weak infrastructure and inefficient managerial and organizational structures. In addition, making use of globalization and obtaining gain from technology transfer requires specific programs to be activated including aggressive policy for scientific and technological advancement, human capital development and building institutional capacity. The Gulf countries are exception in the sense they can easily finance such projects through the surplus of their oil revenues. Similarly, openness to foreign trade creates opportunities to tap global knowledge and absorb foreign technology by allowing people to learn from the use of knowledge in other countries.

In the Arab world in general and in GCC countries in particular, technology transfer is an alternative for locally produced methods, which can be used to enable the economy advancing the process of industrialization and sustain development. At present, access to scientific knowledge and technical advances is within the reach of the Arab countries. Lessons can also be drawn on the experience of others such as those in South East Asia where technology transfer and foreign direct investment have contributed to reducing the technological gap. By setting up new industries, transnational corporations usually employ modern techniques in production process. The benefit to receiving countries could be substantial if the local economy is able to increase linkage creation. In the initial stages of development, such linkage between the local economy and the global markets is necessary to induce economic change in the local economy. However, it will be left for the receiving country to make use of technology transfer by trying to sustain growth through integrating foreign technology into the local economy. Eventually, the domestic production has to be accustomed to the new techniques and along with the improvement in human capital, the country will be in a position to create appropriate technology capable of meeting the domestic requirements. Long run sustainability requires greater management of local resources including technology in order to enable the economy to generate sufficient linkages to sustain economic growth. The Gulf countries can substitute for lack of resources by investing in the human capital and increasing the value added of production. Capital intensive techniques allow the substitution of capital for labour as well as increase productivity (Alvi and Al-Roubaie, 1996).

Capital intensive technology which uses a high ratio of capital to labour could provide a substitute for overcoming market constraints in Gulf countries. To facilitate such usage, greater investment is needed for increasing the stock of human capital and building capacity to absorb technology. In this regard, the quality of labour becomes a decisive factor in increasing productivity. The speed at which technology is adapted in an economy will have a direct impact on the process of economic growth. Thus without technological change, economic development slows and the potential of rapid growth falters. Furthermore, technology helps enhancing factor endowment by prolonging the productivity of domestic resources needed for sustaining growth and meeting future needs. As James Cypher and James Dietz point out:

> "*Technological change is the result of scientific discovery, experiment and innovation, all of which must be financed, either by the private sector or by the state. The successful introduction of technology into the domestic production process in any country, what can be called domestic innovation, requires a domestic scientific establishment capable, first, of understanding, processing adopting and adapting foreign-produced technological knowledge, including machines and tools, to local conditions and later, of conducting its own research, designing its own experiments, and recognizing the potential and, sometimes, dangers of its own discoveries when applied to the domestic economy*." (Cypher and Dietz, 1997, p. 405).

Strong commitment on part of governments in the region needs to be taken in order to strengthen the development of high quality labour and enhance the capacity of the economy to absorb global knowledge and implant them into the local economy. In recent years, information and telecommunication technologies have become attractive industries for those who want to deepen integration and enhance competitiveness. These industries rely more on labour quality than quantity which are more suitable for the existing conditions in Gulf countries. To avoid duplication and reduce competition among member states, a well defined regional plan needs to be formulated in order to establish an integrated framework involving all countries. This also gives them flexibility in reducing the risk of globalization by not competing among each other in the same markets. Diversification of production improves the capability of the economy to sustain growth by generating greater linkages. Within the gulf countries there exist potential for linkage creations to sustain economic development.

Sustainable development requires the building of a broad base networking which brings together the expertise of all countries in order to coordinate and establish mechanisms at various levels. The goal towards promoting sustainable development could be realized faster through the collective efforts of governments in the region. Public participation especially the private sector as well as the general public must be educated to assume greater responsibility in protecting the environment. Governments must also establish monitoring systems for evaluating actions of major economic agents in relation to sustainable development. Despite its environmental damage, modern technology could be employed to design programs for enhancing environmental protection. Along with increasing technical knowledge, restructuring of industrialization can be achieved much faster than expected. This may require building specialized institutions capable of conducting research concerning the selection and implementation of various industrial projects to ensure that technology is compatible with sustainable development. Knowledge for environmental management is necessary if long run economic sustainability has to be maintained. Environmental management should be looked at as a 'complement to development' and not to be regarded as an obstacle. In reference to the importance of knowledge about the environment, the World Bank makes the following propositions for integrating environmental management with development.

- Understanding the environment and the processes that affect it by identifying the sources of environmental degradation, its consequences, and the costs of reducing it, as the foundation for effective policy.
- Developing indicators of environmental performance that policymakers at the local, regional, and the national level can use.
- Using environmental information to improve both public regulation and private decision-making.
- Managing environmental knowledge by building the capacity to gather and disseminate knowledge, improving private sector environmental management, and broadening public policy models to include environmental variables. (World Bank, 1999, p. 100).

Similarly, environmental problems are becoming global caused by cross border trade, people movement, industrial pollution and investment. Therefore, the selection of technology should be evaluated on the basis of its contribution to sustaining development in the entire region. The

spillover effects of inadequate technology could cause long range delay in speeding up the process of development by increasing the environmental costs. Most countries in the Gulf region are oil producing and exporting countries. The supply of energy could produce serious ecological damage by polluting the air and water across the region. Oil spills from pipe lines, tankers and other transport facilities could have far reaching human and environmental consequences. In recent years there has been a tendency to increase the share of petrochemical production in the region via increasing industrialization. However, adopting efficient technologies in these countries could help leapfrogging without adding additional social and environmental costs to their societies. Generally speaking, the energy related technologies are classified into three categories: (1) technologies for the more efficient extraction and transformation of fossil fuels; (2) technologies for the supply of energy from non-fossil sources and, (3) technologies for more efficient energy use (Marstrand and et al., 1991, p. 147).

The selection of appropriate technology could also increase the ability of the region to deepen globalization by enhancing its global competitiveness. However, conflicts may arise from balancing development. Globalization endorses industrial production for export with less attention is paid to the environment. To reduce such negative externalities and enhance effective management requires knowledge about technologies and environmental impacts. "In some cases the transition to sustainable environmental management may depend not so much on the availability of knowledge about appropriate technology, but on the right way of disseminating it." (World Bank, 1999, p. 113). Therefore, sharing information among the countries of the gulf becomes necessary for supporting decisions about policies concerning of the environment. Information and knowledge are also important for increasing understanding about allocation of resources, reducing pollution, enhancing public awareness and sustaining development. The decisions made at present could have considerable impact on future generation. Thus creating, updating and sharing knowledge helps bridging the present with the future by making present generations more willing to make sacrifices for sustaining future generations. Furthermore, environmental management requires enforcement of rules and regulations for which the task of the government becomes essential to ensure compliance.

Given the heavy involvement of public sectors in all countries of the Gulf, governments are responsible for developing strategies aiming at increasing linkages between local and global knowledge. Cultivating the opportunities arising from globalization requires substantial incentives as well as openness to global knowledge and ideas. In addition, investment in new research should be seriously considered to enhance the knowledge about the local environment. The Arabs have large number of highly skilled people of their won presently working outside their countries. Infrastructure should be established along with incentive programs to induce the return of these people and make better use of their knowledge for sustaining development. Without creating local knowledge, global knowledge remains inadequate to satisfy the country's needs. As Clive Thomas explains:

"In a knowledge-based economy, the prevailing cultural, social, economic, political, and institutional conditions favour the generation and dissemination of knowledge and its systematic interaction with technological innovation. Together these linked forces provide the foundations for economic growth in a highly competitive global economy." (Thomas, 2000, pp. 49-50).

CONCLUSION

In this paper, brief discussion on the relationship between technology transfer and sustainable development has been presented. Recent literature on development economics underlines the importance of sustainable development for meeting present and future needs. The Gulf countries in the Arab region are facing serious challenges to increase productivity of their economies and meet the aspirations of their people. Given it is appropriately used and adequately selected; technology transfer could provide a solution to sustaining development in these countries. Because of the small size of population and due to labour shortage, technology allows these countries to substitute capital for labour.

We feel that government action can make a difference by taking the initiatives to increase the capability of the society to sustain development. Knowledge, skills, information, and research and development are important tools for environmental management. The government must ensure that financial, human and physical resources are available for absorption of technology, dissemination of information and increasing knowledge. To be suitable for environmental management, the use of technology must be measured against social and environmental costs. Bridging the gap between global and local knowledge helps sustaining development by creating a balance between the needs of present and future generations. Technology transfer is not only about increasing production and exports, but also about creating dynamic mechanisms capable of linking the present with the future. It is unlikely that markets provide solutions to all problems and therefore societies must work collectively towards formulating policies to help them acquiring knowledge, information and skills in order to strengthen environmental control and sustain development. The Gulf countries have the financial means to draw an effective regional strategy aiming at greater utilization of technology for sustainable development.

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