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Technology Policy for Global Competition: Lessons from East Asia

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Many East Asian countries, including Japan, South Korea, Singapore, Hong Kong and Taiwan, have achieved economic progress through liberalization of their economies and import of technology. In drawing lessons from these success stories their concerted efforts and heavy investment in the areas of education, training, and science and technology, and their policies toward organizational innovations should not be overlooked. Third World countries need to examine closely the connection between technology, population growth, environment and development. It is necessary for them to lay emphasis on quality, design, R&D, market research, information and communication technology, and above all, commercialization and global competitiveness.

MANY of the Third World countries that have recently embarked upon liberalization programmes for their economies might find lessons from East Asia relevant. However, these lessons might serve just as a menu from which to choose items rather than as a package to be implemented wholesale. The major reason for this is that Third World countries are heterogeneous in terms of resources, incomes, needs, and science and technology infrastructure. The fact that some East Asian countries have followed the example of Japan's technological success and carried out the experiment with great success suggests that it could be adapted to suit the specific conditions of Third World countries. The lessons of the East Asian countries such as Japan, South Korea, Singapore, Hong Kong and Taiwan are often cited to demonstrate economic progress achieved through liberalization of economies and import of technology. These countries took their economies from low growth to high growth in a relatively short time through outward-looking, industry-oriented development.

Many scholars have overlooked the concerted efforts and heavy investment made by some of these countries in the areas of education, training, science and technology, and policies towards organizational innovations. Moreover, these efforts were made in a definite international system and historical situation. During this period most economies were expanding and large-scale borrowing to finance their industrial programmes was much easier. In the recent past the international system has undergone a tremendous upheaval—notably in the changes in the economic system of the former Soviet Union and Eastern Europe, and efforts towards political integration of Western Europe. As the erstwhile 'Eastern Bloc' reintegrates itself into the international market economy, it will seek to draw heavily on international financial resources, both private and public. These efforts might increase interest rates and curtail to some extent the funds available to the Third World. The adjustments required for the political integration of Western Europe might also affect to some extent the exports of the Third World to these countries. Moreover, Third World countries that borrowed heavily from international sources in the 1970s and 1980s have to repay their debt now. In 1990, the developing world as a whole transferred $39 billion abroad, and the major portion of this was for debt-servicing. In African countries the debt has risen rapidly in the last decade; these Third World countries have also faced environmental degradation. Hence, the entire nexus between technology, population growth, environment and development needs a careful look.

LESSONS FROM EAST ASIA

In light of the above, the examples of some Latin American countries that have shown high economic growth may not be relevant as these countries are also in debt-trap and have witnessed hyper-inflation beyond 1000%. Yet, Third World countries might like to draw some lessons from East Asian countries and in particular from a country like the Republic of Korea.

Salient features of the Korean economy

The Republic of Korea, which was liberated from Japanese colonial rule in 1945, was still a war-impoverished and rurally based economy in the 1950s. During this period Korea's per capita GNP was only around $70. In 1991, Korea, with a population of 40 million, had per capita GNP of $5400. The average annual growth rate of per

capita GNP for the period 1965–90 stood at 7%. During the last decade the population growth rate has come down to 1.1% from a high level growth rate, inflation has been cut to below 4%, and the balance of payments stands at $4600 million surplus at current account. During the 1980s Korea was moving towards full employment and thus there was an increase in real wages leading to slightly higher inflation.

The present export structure of this country is also interesting. In the 1960s the strategy adopted was of import substitution and hence the export of manufactured items was not significantly high. At present, the export of manufactured items stand at about 96% and more than 70% of exports are destined for developed countries, especially the USA (40%). The USA is finding this situation difficult and is planning to withdraw certain concessions. This policy of export-led growth was principally intended to combat the oil-shock of the 1970s.

One of the important lessons for developing countries from the Republic of Korea is that this country has not simply depended on neo-classical economics but has also relied to great extent on government intervention and assistance. Many laws have been enacted to regulate the economy. One such example is the Foreign Capital Inducement Act of 1966, later amended in 1973, 1983 and 1984. This act emphasized an investment ratio of 50% for foreign direct investment and a foreign investment limit of less than $1 million. In the early 1960s, foreign direct investment was only $8 million and foreign firms were allowed to operate freely, but the new Act encouraged partnerships. During the 1970s investment was allowed only in definite areas. This helped Korea accrue investments of about $400 million. During the 1980s a 'negative list' was introduced during the phase of liberalization. Korea has also maintained a debt-service ratio of less than 22% during this phase.

More interesting lessons are to be drawn from Korea's science and technology policies.

SCIENCE AND TECHNOLOGY POLICIES

The Republic of Korea has a poor resource base in terms of mineral and agricultural wealth. Thus the natural option was to pay more attention to the industrial sector to generate economic growth. Japan also provided an example to follow and there are many parallels between these two countries.

Korea initially depended on domestic markets and paid more attention to import substitution in certain branches such as ship-building, textiles, leather, transport equipment, etc. Subsequently Korea emphasized R&D-intensive branches like electronics and electrical machinery and also entered the automobile sector. This capability was not simply built with foreign technology; Korea started institution building in the 1960s. In 1966 the Korea Institute for Science and Technology (KIST) was established to carry out research. In 1971, the Korean Advance Institute of Science was founded for education. Later in 1981 these two institutes were amalgamated to form the Korean Advance Institute of Science & Technology for industrial research. Sixteen more institutes were established, later reduced to nine for efficient management. Another example of Korea's emphasis on the indigenous development of technology is the case of capital goods. There were 70 enterprises in this sector and these were designated as 'Newly Developed Innovative Machines' (NDIM). Laws were enacted to emphasize local partners and local technology. The local component was set to be maintained at 60% and technical co-operation with overseas companies was barred. Quality was emphasized and a simple copy of a foreign product was not allowed. No foreign component with a critical function could be imported. Korea not only promulgated regulatory laws but some promotional laws as well. Due to government incentives the share of private R&D, which was only 20% in the 1960s, rose to more than 80%. However, as far as capital input is concerned it is now known that scientific productivity is not simply a linear function of financial investment. Scientific productivity is influenced by many socio-psychological and organizational factors. Moreover, there are certain important components, such as design and development that lead to quality improvement, which are not treated as R&D components. These factors play a major role in market innovations and exports. Italy, for example, has specialized in design and development and has shown a growth rate similar to countries that spend more on R&D. Thus organizational innovation plays an important role in the innovation chain. In this regard there are many parallels between Korea and Japan, and thus it might be pertinent to discuss the national innovation system of Japan.

Innovation in Japan

Japan's industry initially depended on 'reverse engineering' from imported technology, and this helped them integrate many aspects. There was a horizontal information flow that encouraged 'system thinking'. R&D was also part of this system, which forced engineers, managers and users to work closely together. With the help of this and other aspects, such as an emphasis on quality and training, the Japanese not only bridged the technological gap but opened another gap between them and the West.

Japan's Ministry of International Trade and Industry (MITI) played a major role in promoting technological advancement. In Korea, too, there are government or quasi-government agencies, such as the Fine Instrument Centre (FIC), which have played a role in training and education. Many private industrial houses have their own training and higher education departments to produce the manpower to suit their needs.

Another step by which technological diffusion

has taken place in Japan is through the development of information and communication technology. Japan has also laid emphasis on 'soft science'—defined as new management methods of forecasting, analysing, planning, and control and evaluation to solve complex situations. This approach has also helped implement industrial technology faster. With limited resources, Japan has now shifted to a knowledge-based industry.

Another important and most essential lesson for Third World countries is that Japan rejected the idea of comparative advantage. This theory assumes specialization in certain areas and leads to an 'imperialist' division of labour. Japan has rather preferred to develop new areas and emphasized small and medium firms, which show greater flexibility towards new innovations.

CONCLUSIONS

In the present international recessionary circumstances, it might not be possible for some less-developed countries to finance their industrial development from international sources or import of technology. Thus these countries might have to depend on indigenous development for their domestic markets. To move to a higher growth path it might be essential to export manufactured goods. This is possible by laying emphasis on quality, design development, market research and 'soft science'. Thus the linearity of the R&D innovation chain might have to be broken and commercialization might have to be given priority—an approach that is lacking in these countries. The increase in R&D budget is a necessary and not a sufficient condition. It is observed that 'market pull' influences innovation to a far greater extent than 'science push'. However, R&D-based innovation introduces far more revolutionary products than yielded by purely market forces.

Another important lesson is that successful innovation requires greater efforts in training and interlinking institutions. Production based on comparative advantage may not have a significant impact on economic growth.

The very fact that developing countries are heterogeneous in terms of their resources, incomes, needs, and science and technology infrastructure helps them forge meaningful international co-operation. These countries can pool resources for their own development.

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