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Techno-Industrial Cooperation for Development in the Two Punjabs

LAKHWINDER SINGH

Introduction

Information technological revolution has reduced information asymmetries across countries/regions and industries. Information can now flow from one agent of production to another at distant places at nearly zero cost. Imitation of technological knowledge and its commercial application is possible at reduced economic costs. Producers of technological knowledge are looking for safer locations and safety measures have been developed and monitored through international agencies so that development and exploitation of technological knowledge can be done at global level. There is also a growing trend towards location of innovation units other than in their home country. Outsourcing of research and development (R&D) centres, opening up of R&D subsidiaries and cooperation among the strategic partners are the fundamental ways chosen to utilize cheap and highly trained labour force by global firms and register the outcome of such efforts in US or European patent offices. Economic agents of production in developing economies still find it difficult to acquire, adapt and utilize technological knowledge that is commercially viable and profitable due to lack of fundamental capabilities and institutional arrangements. Under such circumstances, adaptation of technological knowledge and expansion of technological frontiers of knowledge for self-sustained economic growth require massive innovative investment efforts, which is beyond the reach of a single developing economy.

The commercial exploitation of knowledge through trade liberalization has increased in the last quarter of the 20th century at unprecedented scale in the global economy. Monopolization of knowledge by the advanced countries through favourable patenting regime is the fundamental source to secure comparative advantage in the global economy. This along with the emergence

The author teaches Economics at Punjabi University, Patiala. Email: lkhw2002@yahoo.com.

of genetically modified seeds technology has created opportunities for the firms in the advanced countries to patent the knowledge already existed in less developed countries. Monopoly rights to exploit knowledge at global scale has increased the appetite of the firms in the developed countries to register traditional and well known properties of the fauna and flora of the less developed countries.

The growing importance of the knowledge economy, commercial exploitation of knowledge at global scale and attempt of commercial interests to appropriate the knowledge developed by the civilizations clearly brings out the need for cooperation among developing countries. The two countries of India and Pakistan, and the two Punjabs therein have shared a common history, language and culture, but were artificially divided in 1947. Therefore, it may not be out of place here to explore the possibility of technological and industrial cooperation between the Pakistani and Indian Punjabs, which this paper sets out to do.

Global Trends in Research and Development Expenditure: A Backgrounder

It is widely acknowledged and recognized that economic growth is not merely based on physical capital accumulation and human skills, but on technological knowledge or simply know-how. Historically, countries differ in their effort to generate and acquire that technological know-how which matters for their development. The innovative efforts over a period of time have developed a system in which economic agents of production participate, learn to use and acquire knowledge. This process has not only given birth to a national system of innovation, but also nurtured economic agents of production to be pioneers in exploiting new opportunities and strongly built international comparative advantage. Governments of the various developed countries have strived hard to consciously develop innovative policy instruments and expend matching resources to realize such efforts (Singh 2004). The present phase of globalization is a step of the governments of the developed countries towards reaping the benefits of developed international comparative advantage based on superior technological know-how. To perpetuate this process, the

developed countries succeeded in pushing forward the stronger protection of intellectual property rights regime enacted by the World Trade Organization (Stiglitz 2003).

As the importance of knowledge for development is increasingly realized, more and more countries have started devoting a greater proportion of resources for research and development and this can be clearly inferred from the perusal of Table 1. During the period 1990-2000, the global R&D expenditure has increased from US$ 409.8 billion to US$ 755.1 billion. The major proportion of the global innovative resources has been expended by the developed countries. Developed countries incurred US$ 367.9 billion research and development expenditure in 1990, that is, 90 per cent of the world innovative resources. Obviously, concentration of development of technological knowledge rests with developed countries. This concentration of innovative activities has substantially reduced during 1990s, which is clear from the decline in the relative share of R&D expenditure from 90 per cent in 1990 to 79 per cent in 2000. Developing countries, on the other hand, increased innovative efforts and raised their relative share from 10 per cent in 1990 to 21 per cent in 2000. This trend clearly shows reduction of concentration of innovative efforts in the still highly inequitable knowledge based economy. The perusal of Table 1 clearly shows that the hub of innovative activities is North America, which has the highest R&D intensity.

Table 1: Growth and Structure of R&D Expenditure across Regions

(Figures in billion US$PPP)

Region/Year	1990	1992	1994	1996/97	1999/2000
World Total	409.8 (1.8)	438.7 (1.7)	478.5 (1.5)	549.7 (1.6)	755.1 (1.7)
Developed Countries	367.9 (2.3)	379.7 (2.3)	414.2 (2.1)	460.4 (2.2)	596.7 (2.3)
Developing Countries	42.0 (0.7)	59.0 (0.6)	64.3 (0.5)	89.3 (0.6)	158.4 (0.9)
North America	156.4 (2.6)	175.1 (2.7)	178.1 (2.5)	209.0 (2.6)	281.0 (2.7)

Latin America & Caribbean	11.3 (0.5)	11.5 (0.5)	15 (0.5)	16.8 (0.5)	21.3 (0.6)
Africa	5.2 (0.6)	3.6 (0.4)	4.2 (0.2)	4.3 (0.3)	5.8 (0.3)
Asia	94.2 (1.8)	114.2 (1.3)	127.5 (1.1)	154.8 (1.2)	235.6 (1.5)
Europe	138.8 (1.8)	130.2 (1.9)	147.7 (1.6)	157 (1.7)	202.9 (1.7)

Note: Figures in parentheses are R&D expenditure in GDP.

Source: UNESCO (2004), *UIS Bulletin on Science and Technology Statistics*, Issue No.1, April 2004, UNESCO Institute of Statistics.

The United States of America is the largest both in absolute and relative terms so far as innovative investment is concerned. R&D expenditure increased from US$ 94.2 billion in 1990 to US$ 235.6 billion in 2000 which is slightly more than a two-fold increase in a decade Asia is also gradually emerging as a hub of both economic and innovative activities. Asian R&D expenditure increased faster compared with other regions and improved its relative position from third to second in the global reckoning. Asian countries accounted for 23 per cent of the global innovative investment expenditure in 1990, which increased to 30.9 per cent in 2000. Europe lagged behind because of decline in the R&D expenditure in the East European countries. Two noteworthy facts here are: one, South East Asia and China substantially raised innovative investment expenditure and globally commercial/private sector stakes in innovative investment increased substantially; and two, R&D intensities either slightly declined or remain stagnant across regions except in North America where it improved slightly.

South and South East Asia: An Overview

The differences in innovation investment are substantial across Asian countries. South Asian countries are far behind in putting up innovative investment efforts compared with the East Asian Countries (Table 2). Indicators of technology development and the

technological outcomes, which are presented in Table 2, clearly point out that Taiwan and South Korea marched ahead on the technological ladders. These countries systematically built domestic capabilities over the last quarter of the 20th century. South Korea is the highest investor in innovation activities and incurring 3.0 per cent of the GNP on R&D. Next to Korea is Taiwan. Taiwan's R&D intensity is 2.08. Taiwan is leading in technology development and is ranked number 2 in the whole world, in terms of technology index. Science and technology based manufactured exports from Taiwan to the rest of the world constitutes 39 per cent of the total manufactured exports. Singapore is unique in terms of succeeding in technology development on a model based heavily on foreign direct investment and is also able to combine domestic efforts to march ahead on technological ladders. Its investment in R&D is 1.84 per cent of GDP and 76 per cent of the manufactured exports are high-tech. Its global technology development ranking is 17th. Malaysia is also quite successful in exporting high-tech manufactured goods and services which are solely dependent on the multinational investment. Domestic technological capabilities could not grow in the absence of building of domestic innovative capabilities. Lately, China has raised substantially the investment in innovations and crossed the one per cent mark of GNP.

Table 2. Indicators of Technology across South Asia and East Asian Countries

Country	Share of R&D in GNP	High-tech exports as % of Man. exports 2002	Techno-logy index rank 2002	Foreign direct investment in million US$ 2002
Bangladesh	0.03 (2000)	0.00	79	47
India	0.60 (2000)	5.00	57	3030
Pakistan	0.92 (1987)	1.00	-	57
Sri Lanka	0.3	1.00	67	242

Indonesia	0.07 (2000)	16.00	65	-1513
Rep. of Korea	3.0 (2002)	35.00	18	1972
Malaysia	0.42 (2000)	59.00	26	3203
Singapore	1.84 (1999)	63.00	17	6097
Taiwan	2.08 (2000)	39.00	2	-
Thailand	0.16 (2001)	32.00	41	900
China	1.1 (2002)	23.00	63	49308

Sources: World Economic Forum, 2003; UNDP, 2004; and World Bank, 2004.
Note: Figures in parentheses are the year of availability of R&D expenditure.

The success of China in attracting foreign direct investment and international trade has been widely recognized. However, China's global technological ranking based on technology index is 63, which is quite low.

Other East Asian countries are moving ahead in terms of raising technology as a factor in their respective economic development. Still, they lag way behind so far as generation of capabilities for development of technological knowledge is concerned. International technological ranking of Malaysia, Thailand and Indonesia is quite low. Differential performance of East Asian countries in technology development clearly points out that there is no substitute of systematically building domestic technology development capabilities. Foreign direct investment can perpetuate technological dependence and domestic agents of production continuously upgrade and adopt technologies developed elsewhere. This in the long run depletes resources and cripples capabilities to become leaders in innovations because technology import involves substantial costs. The fundamental

lesson which is quite obvious from successful East Asian countries, that is, South Korea and Taiwan, is that the strategic state intervention in enhancing innovative investment along with selective/restrictive role of foreign direct investment has succeeded in building national innovation system.

India has been recognized as the 10th largest spender in innovation activities in absolute level and is the most sought after place for location of R&D centres from the multinational corporations. When we look at hard data related to technology development, she is ranked 57th according to technology development index among the 80 nations for which comparable science and technology statistics are available. India's share of R&D in GNP was just 0.6 in the year 2000 which has declined in 1990s. The decline in R&D intensity is attributed essentially to two factors. One, there was faster rate of growth of national income during 1990s. Two, the contribution of the government of India to R&D spending declined/stagnated in the wake of controlling the fiscal deficit. However, the science and technology (high-tech) based share of exports in the manufactured exports has increased continuously. The share of high-tech exports in the manufactured exports is 5 per cent. When we compare India's share of high-tech exports with the East Asian countries, her achievement is almost miniscule. Despite this, India is well recognized globally in the pharmaceutical and information and communication technologies based products and innovations.

The other major country in the South Asian region is Pakistan, which also is a globally recognized nuclear power. From the civilian technology development point of view, its international recognition and contribution seems to be quite low. Pakistan's share of high-tech exports in the manufactured exports is just one per cent. Another important indicator of technology development is the work force engaged in R&D activities. Researchers engaged in R&D are 69 per million persons which is quite low compared with other South Asian countries (Sri Lanka and India employed 191 and 157 researchers per million persons respectively). Foreign direct investment flow, which is considered as an important source of technology transfer, is quite low in general to South Asian countries. Pakistan received US$ 57 million FDI in the year 2000,

which again is low, compared with Sri Lanka and India. R&D intensity is nearly 1 per cent of the GNP of Pakistan which is much higher compared with other South Asian countries. Industrial enterprises in Pakistan hardly do any formal research and development expenditure (Lall 2000). However, the statistics related to R&D expenditure of Pakistan that are available for the year 1987 do not allow us to examine the recent trends.

Technology and Industrial Cooperation: The Two Punjabs

Theory and historical evidence on the relationship between technology and industrial development has clearly established close linkage between the two. Production structure, in the two Punjabs, has exhibited a somewhat similar pattern and is heavily dependent on agriculture (Table 3). However, the tertiary sector has gained substantial importance and has reduced the relative importance of the real sectors of the Pakistan Punjab's economy in the state domestic product. Indian Punjab is also following the same pattern of economic growth except the two productive sectors - agriculture and industry - dominate in its state domestic product.

Table 3: Comparative Structure of Economy of Pakistan Punjab and Indian Punjab

Sectors	Agriculture percent in SDP	Manufacturing percent in SDP	Others percent in SDP	SDP growth rate
Pakistan Punjab (2001-02)	27.3	15.9	56.8	4.5(1991-2002)
Indian Punjab (2001-02)	38.7	16.6	44.7	4.6(1990-2000)

Note: Figures in parentheses are the years.
Source: 1. World Bank, 2005; ESO, 2002; and Bhattacharya and Sakthivel, 2004.

Industrial sector, which is expected to be the engine of growth of modern economy, has not shown dynamism and

remained marginal sector of the economy of both the Punjabs. Industrial growth has been based mainly on factor accumulation and technology could not play its dynamic role due to lack of investment in research and development. The recent phase of globalization has raised the consciousness among the economic agents of production for technological development to raise standards for survival in a fierce competition. However, the two governments have relatively placed greater responsibility of technology development in private hands. To allow private producers of technology to exploit and perpetuate their comparative advantage in international market, intellectual property rights have been transformed from public to private and enforcement is strictly monitored. This has made adaptation of technology by the follower countries and economic agents of production difficult and costly. In this context, reputed intellectuals and international agencies have recently shown harmful effects of monopoly rights provided by the World Trade Organisation to multinational corporations (Stiglitz 2003). Therefore, the United Nations Development Programme suggested the role of international agencies and cooperation among the developing countries for reducing the technological gaps. The two Punjabs, through their respective national governments, must come forward together for protecting existing intellectual capital as well as for developing the most relevant technologies that are of mutual interest. There are numerous areas in which cooperation among them will go a long way to preserve and develop intellectual capital for international competitive advantage.

It is commonly accepted wisdom that universities are established to generate knowledge and disseminate knowledge. The evolution of universities in the West has shown that they have grown from the generators and disseminators of knowledge to knowledge enterprises. However, the universities in developing countries in general and Punjab universities in particular are purely concentrating on disseminating knowledge and the innovative goal of the universities seems to have been forgotten. At early stages of development, training of human skills plays an important role, but dependence on imparting and disseminating purely Western knowledge will create (has already created) and

perpetuate imbalances between skill requirements of the economy and the trained manpower. Thus, it is high time to reorient the role of the universities to generate knowledge and disseminate knowledge for industrial development of the region's economy. To achieve this goal, governments of both the Punjabs should provide adequate financial resources and promote greater linkage between the universities. Project-oriented Faculty Exchange Programme on regular basis needs to be established. Punjabis living abroad have a substantive role to help in enactment of such projects and also enable universities to locate suitable persons and institutions, which can also finance such programmes.

Governments of both the Punjabs with the help of Punjabis residing in developed countries, should establish young scholars' exchange programmes to tap and harness talent for scientific and technology development for this region. Such regular exchange of scholars and knowledge will reduce the cost of production and dissemination of knowledge. Application of the knowledge developed by joint efforts of scholars in the two Punjabs will increase the area of operation and increase economies of scale.

The university-industry interface needs to be established so that university scholars must be made aware of the problems faced by the industry. Technological choices, market for output and production processes of an industry require the help of highly skill-oriented faculty which only universities can provide. Industry associations must cooperate to provide financial help in establishing high-tech laboratories and research centres in the universities for future development of these technologies and other kind of expertise. Involvement of industry will also ensure utilization of the research outcomes.

Transformation of the economies of two Punjabs from agrarian to industrialized one and from industrialized one to knowledge based economies should be the desired objective. To march on the process of transformation, it is desired to harness the on going biotechnological revolution. Biotechnological revolution has a capacity to raise the productivity of agricultural crops multiple times. Improvement of quality of the existing products through biotechnology and building agro-processing facilities with joint cooperation will help to initiate the process of economic

transformation. Protection of existing common intellectual wealth of the region from the foreign intellectual capital appropriators requires cooperation of both the Punjabs. More specifically, *basmati* patenting attempt by the name of taxmati by US based scientists clearly needs cooperation not only to save intellectual resources but also to use and enhance international comparative advantage through biotechnology and agro-processing of such specialties.

Agriculture machinery and information technology are the other two areas where cooperation is desired to be established to harness the expertise and further development of these industries for mutual benefits.

It is also desired to establish something of the nature of Punjab Venture Capital Fund to finance risk-based activities for the knowledge-based economies of both the Punjabs. Punjabis living in other countries that have made substantive fortunes and are looking for opportunities to develop their home region need to be tapped for contributing to this fund. The fund should be used to finance industrial activities on Israel's pattern. It needs to be emphasized that the two countries can cooperate for mutual benefits and can still maintain their individual identity in this whirlpool of globalization.

Conclusion

The central idea that has emerged from the development experience during the last quarter of twentieth century is that successful industrial development requires not only narrowing down the gap in resources between developed and developing countries but also lessening the gap in technology as well as in knowledge. Transformation of the economies of the two Punjabs from agricultural to industrial ones requires explicit development of technology policy by the respective governments to reduce the gap in technology and knowledge. Techno-industrial cooperation between two Punjabs needs to be initiated with all seriousness. Cooperation is desired to develop broad intellectual infrastructure. The two Punjab governments should work hard to initiate process of establishing high-tech research institutions. We need a coterie of individuals, who are able to absorb knowledge, codify it, and adapt it to the situation in the two Punjabs. Cooperation is desired

to forge alliances between research institutions, educational institutions, and industry. Joint ventures in high risk activities between public and private sectors in both the countries will go a long way in economic cooperation. Punjabis residing in developed countries not only can help in providing financial resources but can also be helpful in establishing research and development centres which can identify and develop technological knowledge suitable to the situation of the two Punjabs.

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