Technology Upgradation through Global Value Chains: Challenges before BIMSTEC Nations

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Abstract

Enhancing productivity through technological upgradation is one of the key drivers of high economic growth. Developing countries have relied on imported technology, licensed know-how and foreign direct investment (FDI) for firm-level technological diffusion and spillover. However, with international production systems being integrated into 'global' networks, access to advanced technology for developing country enterprises has become critically dependent on their abilities to enter and move up global value chains. This paper attempts to study such possibilities for firms in some BIMSTEC nations in the context of global production networks dominated by Japanese lead firms. The paper examines extant national technological capabilities, in terms of efficiencies in applying advanced technologies to commercial applications, as well as innovative capacities for tackling more advanced operations. The findings indicate India as the leading BIMSTEC nation having capabilities for taking on diverse 'high-end' activities, with other nations requiring considerable technological 'catching-up'.

1. Introduction

Globalisation has produced remarkable changes in business structures and organizations across the world. A key upshot of these changes has been greater synchronisation of economic activities across borders leading to emergence of trans-national production systems, organised as distinct global production networks. Advent of these networks has been followed by rearranging of industrial structures, which has influenced the process of local development. For developing country enterprises, successful entry into global production networks has emerged as a key challenge. Entry into global chains promises upgradation of firm-level capabilities from 'learning' through technology diffusion and exposure to international best practice systems of corporate governance. However, the ability of developing country firms to move into global chains and graduate to 'high-end' activities depends on their existing technological capabilities, as well as the support mechanism made available by national country governments.

This paper attempts to examine the possibility of firms from some select BIMSTEC nations moving into global chains and acquiring higher technological capabilities in the process. In particular, the paper aims to study such possibilities in the context of global value chains managed by Japanese lead firms. The paper is divided into five sections. Section 1 provides a theoretical construct for global value chains. Section 2 examines how technological capabilities can improve by entering global chains. Section 3 studies existing technological capabilities of a select group of BIMSTEC nations. Section 4 explores the possibilities of firms from these nations moving into Japanese global production networks. Finally, Section 5 provides a tentative policy agenda for enhancing firm-level capabilities for facilitating successful integration into international production networks.

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2. Global Value Chains: A Theoretical Construct

Globalisation has resulted in radical reorganization of production networks across the world. These reorganisations have given rise to complex, systematically integrated, and sequentially ordered production arrangements. Global production has become synonymous with well-knit distributions of different discrete stages of production spread across various locations. Such arrangements typify growing functional integration between internationally dispersed activities. They also symbolize gradual 'internationalisation' of production, where sequences of related activities are executed in trans-national fashion.

Any production activity can be construed as a value-adding process. Value added by the final product is aggregation of values generated in different stages of production. All production activities, therefore, can be conceived in terms of value chains. These chains differ between industries and activities. Within industries as well, value chains vary between firms, depending upon specific natures of enterprise activities.

Value chain analysis is an important tool for studying supply management functions in different industries. Such analysis, however, has become more complex in recent times due to emergence of 'global' value chains. A 'global' value chain is distinct from a local or national value chain in terms of its role in coordinating activities situated in different parts of the world. The global automobile industry is a typical example. Mercedes Benz, a leading German automobile manufacturer, has production facilities in Brazil. Designs for models being manufactured at the Benz's Brazilian plant are developed through collaboration with suppliers based in Europe. On the other hand, certain key parts (e.g. engine, gear-box, rear axle etc.) are imported from Germany, while some others (e.g. seats, wheels, petrol tanks, taillights) are obtained from suppliers located elsewhere, as well as local manufacturers (Humphrey, 1999).
As the Benz example indicates, global value chains symbolise alliances between lead firms (buyers) at one end of the chain and suppliers at various other levels. These alliances give rise to different kinds of governance structures within the chains reflecting the balance of power between buyers and suppliers. At the same time, these alliances also create significant upgradation opportunities for suppliers, depending upon the nature of interaction between buyers and suppliers.

The theoretical literature on global chains focuses upon four major interactions between buyers and suppliers (Humphrey and Schmitz, 2002; Schmitz, 2005). These are arm's length (for customised products, where buyers and suppliers transact through the market and do not develop close relationships), balanced networks (characterised by mutual inter-dependence, where product development is a joint responsibility leading to close information-intensive relationships), captive networks (underlining unequal balance of power between buyers and suppliers, with the buyers monitoring execution of almost all key activities) and hierarchy (a more extreme version of a 'captive' network with lead firms acquiring ownership of certain operative stages).

A somewhat different classification of global production networks (Gereffi 1994, 1999) distinguishes value (or commodity) chains between 'producer-driven' and 'buyer-driven' varieties. The main point of distinction arises from the nature of lead firms' governing the chains. While many multinationals possess distinct comparative advantages in production-related activities (e.g. industrial research & development), several others, in contrast, do so in non-production segment[1] (e.g. design and marketing). The former, by virtue of the very nature

[1] Major global retailers in garments and footwear (e.g. Nike, Reebok, Wal-Mart), as well as fashion-oriented international brand names (e.g. Liz Claiborne) do not engage in direct manufacturing. They emphasize on design, sales, and marketing, while sourcing manufactures from production centers in

of their comparative advantages, are more prevalent in capital and technology-intensive industries (e.g. automobiles, software etc.), while the latter dominate relatively low-technology labour-intensive activities (e.g. garments, footwear etc.). The classification also indicates that chains with 'producer' lead firms are vertically organised with entry barriers in form of scale economies. The 'buyer' chains, on the other hand, are horizontally configured.

The conceptual underpinnings of global value chains point to the importance of alliances between cross-border firms in shaping and organising modern production systems. In variedly different ways, developing country firms are increasingly figuring in these chains. As more and more developing countries push forward in their attempts to globalise, the role of global value chains is expected to assume greater importance for upgradation prospects of local enterprises.

3. Technological Capabilities and Global Value Chains

For analytical convenience, we divide this section into three parts. Part 1 defines technological capability and the process of acquiring such capabilities. Part 2 underlines the role of foreign direct investment (FDI) in providing advanced 'know-how' to developing country firms in their initial technological efforts. Finally, Part 3, contextualises technology upgradation with respect to global value chains.

3.1 Technological Capability

Technological capabilities vary widely across nations depending upon a host of country-specific factors. These include, *inter alia*, the nature and quality of scientific and technical institutions, expenditures incurred by government and business on technological development (R&D in particular), availability of skilled manpower, prevailing intellectual property systems etc. Acquiring technological capability is a dynamic and evolutionary process and nations are classified as 'more' or 'less' technologically capable according to their stages of technological development.

Technological capability of developing countries is defined as the capacity of these countries to select, assimilate, adapt and improve given technologies (Lall, 1985). The various stages of building-up technological capability, or 'learning', can be described as follows (Guha and Ray, 2004).

- Learning by doing.
- Learning by adapting.
- Learning by design.
- Learning by improved design.
- Learning by setting up complete production systems.
- Learning by designing new processes.

Most developing countries, typically, start learning, by acquiring imported technology. Initially, they focus on optimal utilization and adaptation of both indigenously available, as well as imported technologies, for increasing productivity. These early attempts, according to the literature on technological capability and effort[2], can be classified as the phase of

low-cost overseas locations. These companies are often referred to as 'manufacturers without factories'. See Ramaswamy and Gereffi (2000).

[2] Technological effort is defined as "conscious use of technological information and accumulation of technological knowledge, together with other resources, to choose, assimilate and adapt and/ or to create new technology" (Bell, 1984).

acquiring 'know-how' for achieving rapid gains in total factor productivity (TFP)[3]. Advanced know-how is obtained through a combination of efficient assimilation of imported techniques, quality control, improved plant layout and production practices, equipment modifications, use of different raw materials and so on (Lall, 1985). For most developing nations, acquiring know-how is a lengthy process. Know-how is followed by 'know-why' in the next stage of technological development. Acquiring know-why implies understanding the nature of the process and product technologies leading to the development of new and improved designs (Guha and Ray, 2004).

In planning their technology policies, developing countries are often caught in the dilemma of 'know-how' versus 'know-why'. The choice, indeed, is not easy. Advanced know-how facilitates immediate TFP improvements and higher output growth. However, know-why does not result in immediate benefits in terms of productivity gains in the short and medium terms. On the other hand, without know-why, developing countries can hardly aspire to reach advanced levels of capabilities, since it is only know-why oriented technological learning which can provide the foundation for acquiring frontier R&D capabilities (Guha and Ray, 2004).

3.2 Technological Capabilities and FDI

In the initial stages, developing countries depend significantly on advanced nations for acquiring technological capabilities. In this regard, there are two main sources for accessing advanced know-how. The first, and most common source, is technology imports. However, scarce foreign exchange reserves often constrain the ability of acquiring technology imports. As a result, many developing countries rely on the second source, which involves arm's length arrangements like technology licensing. However, such transactions in the know-how market often lead to high transaction costs on account of informational asymmetries (Magee, 1977; Caves, 1982). The latter give rise to problems of adverse selection, where the buyers of know-how (i.e. local licensees), are largely unaware of the intrinsic features of the technology being transacted, and the sellers (i.e. foreign firms) are unable to disclose the same to the former. Sellers, therefore, do not expect premium for quality and are inclined to transact inferior products, knowing which, the buyers tend to quote lower prices for the product. The eventual outcome is gradual withdrawal of sellers of quality products from the know-how market (Guha and Ray, 2002).

These market failures have encouraged developing countries to look at FDI as a key vehicle for obtaining advanced technology and know-how. As opposed to market-based arm's-length arrangements like licensing, FDI is an 'internalised' form of technology transfer. The main advantage with such form of technology transfer is the long-term commitment to the host economy attached with FDI decisions. As a natural corollary of such commitment, affiliates of multinationals play active roles in adapting and improving technologies in host nations, thereby creating significant scope for technology spillover (UNCTAD, 2003).

2.3 Global Value Chains and Technological Upgradation

There is a noticeable change in multinational production systems in recent times, which has important implications for technology diffusion in developing countries. Unlike in the past, when subsidiaries of multinationals in different host countries used to carry out a variety of functions themselves, now-a-days, there is a marked tendency of locating several key high-value functions (e.g. R&D, engineering etc.) in different countries. Decisions to globally disperse various activities stem from the motivation to reduce costs. With globalization

[3] Solow (1957) identified Total Factor Productivity (TFP) as a 'residual', which explained growth in output not accounted for by physical factors of production like land, labour, capital etc. TFP is often referred to as technical progress, which has been recognized as a key factor influencing output growth.

offering more locational choices, and advances in information technology reducing the cost of doing business across borders, multinational enterprises find it more economic to locate various stages of production in different host countries. However, core high-value functions like R&D are being relocated mostly among advanced nations, since the majority of developing countries, barring a few (China, India, Singapore and Taiwan are the leading South-East Asian economies with strong R&D capacities), lack such capabilities. But many relatively medium and lower-end functions in value chains are moving to developing countries. It is evident that value chains of multinationals are increasingly becoming more 'globalised' in place of their earlier 'internalised' forms. Linking local production chains to these 'globalised' value chains contain a potent source of technology transfer and skill development for developing country firms (UNCTAD, 2003).

Entry into global chains can occur in two ways. The first is through FDI. The second, and the increasingly popular route, is through offshore outsourcing work. Global lead firms are outsourcing more and more of their production processes to efficient overseas enterprises. Such outsourcing ranges from relatively 'low-end', primarily assembling operations, to more 'high-end', complex, R&D-intensive work, depending upon capabilities of overseas firms. For developing country firms, the main challenge is not only to enter the global chains, but ensure sustained upward mobility in such networks through continuous learning and upgrading (ILO, 1998).

Needless to say, moving into production chains involving manufacture of high-technology products contains the biggest scope for diffusion and technology spillover. Exports of high-technology manufactures are growing at the fastest rate among all categories of exports[4] and are the leading drivers of world trade. Such trade is dominated by large multinationals, which are also the main innovators of new designs and processes. Given the paramount importance of knowledge as the main source of competitive advantage in high-technology manufactures, global value chains in such products are usually organised as *captive* networks with lead firms exercising tight control over production. Entering these chains creates ample scope for technological upgradation for developing country firms, on account of the heavy demands imposed by lead firms on reducing cost and enhancing quality (Schmitz, 2005). However, while the former might find themselves at strategically favourable positions on the learning curve upon entering these chains, the extent by which such curves steepen in future, depends on firm-specific capabilities for upgradation, which, in turn, depend, *inter alia*, on country-specific initiatives aiming to enhance overall technological effort.

Enhancement of firm-level capabilities also depends on whether global lead firms visualize production in host countries for catering to the latter's domestic markets or exports elsewhere. Export-oriented FDI in developing countries aiming to address relatively high-income consumer tastes in advanced countries imposes greater qualitative stipulations on host country firms that are part of such output generation. On the other hand, market-oriented FDI in developing countries, entails relatively lower qualitative demands for host country firms in value chains, since consumers in developing country markets are likely to have less sophisticated tastes and preferences.

3. Technological Capabilities of BIMSTEC Nations

The Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) is a regional grouping comprising seven economies of the South-East Asian region[5]. The grouping was kicked off in June 1997 by four economies of the region:

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[4] During the period 1985-2000, high-technology (HT) exports experienced a growth of 13.19 per cent. During the same period, low-technology products (LT) grew by 8.85 per cent, while medium-technology products (MT) grew by 8.45 per cent. See UNCTAD (2003).

[5] See http://www.bimstec.org.

Bangladesh, India, Sri Lanka and Thailand. Subsequently, the scope of the initiative was enlarged by including Bhutan, Myanmar and Nepal.

In this section, we look at the extant technological capabilities of BIMSTEC nations for assessing their prospects of entry into global value chains. Due to lack of comparable data on technological progress indicators, we confine our analysis to four primary BIMSTEC members, i.e. Bangladesh, India, Sri Lanka and Thailand. Our data sources are the Global Competitiveness Report (2005-06) brought out by the World Economic Forum (WEF), the Human Development Report (2005), and the World Investment Report (2005) of the United Nations.

We begin our analysis by examining technological readiness[6] and innovation[7] capacities in the four BIMSTEC nations. These are shown in Table 1. Technological readiness and innovation, respectively, reflect the ability of a country to efficiently apply existing technology and its capacity to generate new technologies (WEF, 2005). The concepts broadly indicate the current and future technological capabilities of nations. As can be seen from Table 1, Thailand tops the four countries in technological readiness ranking, while India tops in innovation. Sri Lanka and Bangladesh appear at third and fourth positions, respectively, in both indicators.

Table 1: Technological Readiness and Innovation in Selected BIMSTEC Nations

Country	**Country Ranks**	
	Technological Readiness	**Innovation**
Bangladesh	4 (106)	4 (98)
India	2 (57)	1(27)
Sri Lanka	3 (85)	3 (69)
Thailand	1(49)	2 (38)

Note: Numbers in parentheses indicate the respective ranks of the individual countries among 117 countries surveyed by the Global Competitiveness Report (2005-06).
Source: Global Competitiveness Report, 2005-06

It is interesting to note the gaps between India's overall international rankings in the two categories. While India is ranked 57 out of 117 countries in technological readiness, its rank in innovation is at a much higher 27, underlining its success in developing fairly strong capabilities in generating new technologies, alongside somewhat modest achievements in cultivating technological readiness. On the other hand, the relative ranking gap is smaller in case of Thailand, which shows that Thailand's level of technological readiness is not much behind its innovative capacities.

The technological readiness indicator, as developed by the Global Competitiveness Report, takes into consideration a variety of factors for constructing the index[8]. The information and

[6] According to the Global Competitiveness Report (2005-06), 'Technological Readiness' relates to factors which facilitate and enable the technological capacity of a country. This includes the general availability of technologies and the penetration rate of information and communication technologies (ICT). Access to ICT is considered a particularly critical component of technological readiness, since such access helps in establishing effective and rapid communication systems, as well as providing an efficient indicator for commercial transactions. See WEF (2005), p. 24.

[7] Innovative capacity is essential for developing dynamic national competitive advantages based on technology and skill-intensive industries, as opposed to static advantages, that grow out of low production costs. Development of such dynamic advantages depend on joint efforts of both public and private sector, quality of scientific research institutions, skilled workforce, availability of scientists & engineers, R&D expenditure and intellectual property protection. See WEF (2005), p. 24.

[8] The Global Competitiveness Report uses two forms of data for computing indicators. The first is data available from secondary sources. The second is survey data obtained from executive opinion surveys

communication technology (ICT) infrastructure is an important constituent of this index. One of the reasons behind Thailand performing better in technological readiness is its success in 'deepening' the ICT infrastructure. In this regard, Thailand, fares much better than Bangladesh, India and Sri Lanka. The comparative positions are shown in Table 2.

Table 2: ICT Infrastructure in Selected BIMSTEC Nations

Country	**Telephone Mainlines**		**Cellular Subscribers**		**Internet Users**	
	(per '000 population)					
	1990	**2003**	**1990**	**2003**	**1990**	**2003**
Bangladesh	2	5	0	10	0	2
India	6	46	0	25	0	17
Sri Lanka	7	49	…	73	0	13
Thailand	24	105	1	394	0	111

Source: Human Development Report, 2005

In all components of ICT infrastructure (i.e. access of population to telephone mainlines, cellular subscribers and internet users), Thailand has an edge over the rest of the nations. It is interesting to note that during 1990, the four BIMSTEC nations were practically at the same level in terms of cellular subscribers and Internet users. However, between 1990 and 2003, Thailand's progress in these two respects has far outstripped the others. Sri Lanka and India compete with each other for the second position in ICT infrastructure with Sri Lanka performing somewhat better in telecommunication facilities and India in Internet connectivity. Bangladesh fares disappointingly in Internet penetration and telephone connections, while doing slightly better in expansion of cellular subscriber base.

Beyond ICT infrastructure, which is one of the critical components of technological readiness, overall technological development, in terms of firm-level and institutional capabilities, skilled manpower, and innovative potential, presents a different picture between the four countries. We look at a few core indicators in this regard (i.e. technology absorption by local firms, innovation capacity, availability of scientists & engineers, university-industry collaboration, R&D undertaken by the corporate sector etc.), which impact technological readiness, as well as abilities for generating new technologies, in Table 3.

In terms of the nine indicators in Table 3, India leads the four nations in all, except university-industry collaboration and the role of FDI in technology transfer, where Thailand does better. The most striking difference between India and the rest of the nations is in terms of availability of scientists and engineers, where India happens to enjoy the highest global rank. As far as other indicators are concerned, the difference between India and the next closest nation, i.e. Thailand, is marked with respect to firm-level technology absorption, innovation capacity, quality of scientific institutions and corporate R&D. Sri Lanka, which appears in the third place among the four nations for most indicators, does somewhat better than Thailand in innovation capacity, but figures at the very bottom in firm-level technology absorption. On the other hand, Bangladesh, which is at the fourth place for most indicators, does better than Sri Lanka and Thailand in terms of availability of scientists and engineers.

What do these results indicate in terms of levels of technological capabilities acquired by the four nations? On the basis of our discussions in Section 2 and the evidence on technological infrastructure in BIMSTEC nations, we arrive at the following broad conclusions regarding technological capabilities of the four BIMSTEC nations.

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carried out in different countries. While computing technological readiness, indicators like firm-level technology absorption, ICT laws, FDI and technology transfer, cellular telephones, internet users and personal computers are used. For the first three categories, the Report uses executive opinion survey data and for the latter three data available from secondary sources. See, WEF (2005)

Table 3: Technological and Innovation Indicators of Selected BIMSTEC Nations

Particulars	Bangladesh	India	Sri Lanka	Thailand
Firm-level tech absorption	3(76)	1(19)	4(77)	2(38)
Prevalence of tech licensing	4(83)	1(7)	3(80)	2(16)
Innovation capacity	4(94)	1(31)	2(55)	3(62)
Utility patents	4(81)	1(56)	3(74)	2(60)
Scientists & Engineers	2(60)	1(1)	3(64)	4(69)
University-industry collaboration	4(105)	2(36)	3(83)	1(28)
Corporate R&D	4(99)	1(27)	3(77)	2(37)
Quality of Scientific institutions	4(78)	1(17)	3(62)	2(41)
FDI & technology transfer	4(83)	2(34)	3(62)	1(23)

Note: Numbers in parentheses indicate the respective ranks of the individual countries among 117 countries surveyed by the Global Competitiveness Report (2005-06).
Source: Global Competitiveness Report, 2005-06

(i) India and Thailand lead the four nations in overall technological capabilities. Indeed, technological capabilities of these two countries are much higher than those of Bangladesh and Sri Lanka. In this sense, there is fairly noticeable technological 'inequality' in the region. However, both India and Thailand appear to suffer from 'mismatches', albeit of opposite natures, between their technological readiness and innovation capacities.

(ii) Between India and Thailand, the former has developed stronger innovation capabilities. Such capacities, aided by ample availability of scientists and engineers produced by high-quality scientific research institutions, make India an attractive destination for handling complex, high value added operations[9]. Advanced innovative faculties, coupled with abundant human capital, also indicate that India has been successful in acquiring 'know-how' and is expanding 'know-why' for gathering frontier R&D capabilities. However, in terms of technological readiness, particularly expansion of ICT infrastructure, India's progress is somewhat limited. These contrasting facets suggest that while India has to cover ground in making ICT tools available across the country, and therefore, as of now, might find it difficult to handle large volumes of IT-based manufacturing applications at the enterprise level, it is reasonably well-prepared for taking on 'high-end' work involving advanced technologies.

(iii) Thailand, on the other hand, has taken rapid strides in technology exports[10] and has succeeded in spreading ICT facilities fairly deep. However, unlike Singapore or the Taiwan Province of China, which have utilized FDI for enhancing domestic technological capabilities for handling complex R&D-based operations, Thailand, much like Malaysia, Philippines, and Indonesia, has not been able to do so. This may, partly, be on account of its greater thrust on 'assembling' high-technology exports, as opposed to harnessing R&D for new technologies. The 'deepening' of ICT facilities in Thailand has not been accompanied by similar 'deepening' of technological effort towards stronger innovative capacities. One of the main reasons for this is the shortage of quality scientists and engineers and somewhat deficient capabilities of its technical and scientific educational institutions (UNCTAD, 2003). Indeed, in terms of sheer numbers, the volume of technically qualified manpower, which can play a key role in acquiring know-why, appears to be quite limited in Thailand vis-à-vis India (Table 4). This apparent mismatch between the ability to use foreign technology for efficient assembling of hi-tech exports and lack of similar ability for generating new technology can adversely affect efforts to move into higher ends of global value chains.

[9] UNCTAD's Survey (2005-09) on R&D-intensive FDI places India as the third most attractive destination in the world for such FDI, after China and the US. See, MoF (2005).

[10] In the year 2000, Thailand was the 8th largest exporter of high-technology manufactures in the world. See UNCTAD (2003).

Table 4: Enrolment at Tertiary Level and Technical Subjects: 2000-2001

Country	Total Tertiary Enrolment		Tertiary Technical Enrolment	
	(in '000)	Rank	(in '000)	Rank
Bangladesh	879	26	119	34
India	9834	3	1913	3
Sri Lanka	65	83	16	77
Thailand	2096	12	185	25

Note: Technical subjects at tertiary level include science, engineering, mathematics and computing
Source: World Investment Report, 2005, UNCTAD

(iv) Bangladesh and Sri Lanka are much behind India and Thailand in both technological readiness as well as innovative capacities. Both countries appear to be in the early stages of acquiring know-how and are yet to acquire capabilities for generating new technologies. However, as between India and Thailand, Bangladesh and Sri Lanka's technological development trajectories also present interesting contrasts. Sri Lanka seems to have an edge in ICT infrastructure, along with innovation capacity, with corporate R&D showing signs of picking up. Bangladesh, while lagging behind in most indicators, has a fairly large body of scientists and engineers, which reflects positively on its quality of human capital. However, both countries have been largely unsuccessful in utilizing FDI as a source for advanced technology. This, in fact, is one of the main reasons behind the inability of these nations to acquire higher technological capabilities.

4. Prospects for Moving into Global Value Chains under Japanese Leadership

In Section 3, we had indicated that developing country firms can move into global value chains in two ways. The first is through FDI undertaken in host developing countries by advanced country firms. Such investment creates strong scope for technology spillover among local enterprises. The latter can not only 'learn' from exposure to advanced know-how, but can also upgrade by supplying to multinational affiliates in line with their sophisticated requirements and specifications. These strategic alliances between affiliates and local firms have resulted in growth of many capable and competent vendors in developing nations. The second opportunity for moving into global value chains arises from offshore outsourcing. As mentioned earlier, with lead firms locating production activities in different parts of the world on the basis of locational attributes, offshore outsourcing has acquired prominent global dimensions, creating enormous scope for entry of developing country firms into global production networks.

Before examining the possibilities of BIMSTEC firms moving into Japanese value chains, it is important to flag some key aspects of Japanese FDI. Globally, manufacturing FDI from Japan has tended to flow heavily into two key sectors - automobiles and electronics – for maintaining international competitiveness. Among BIMSTEC nations, for example, Japanese FDI has flown significantly into India's automotive sector. On the other hand, Thailand has been a leading recipient of Japanese FDI in electronics[11]. This is, of course, not to suggest that Japanese FDI has not moved into other sectors in these countries. Thailand has traditionally received large volumes of Japanese FDI in textiles and transport machinery. On the other hand, Japanese FDI in India, though a relatively late-starter, has started making inroads into chemicals, consumer electronics and financial services.

A measure of internationalization of Japanese industries (in terms of overseas production as a proportion of total production) indicates that automobiles (assembled) have the highest

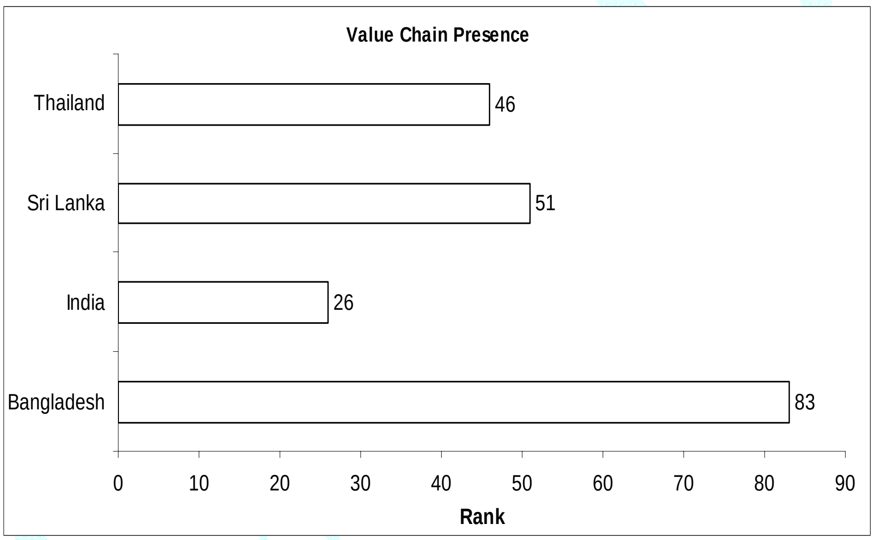
[11] During the period 1988-1995, Japanese FDI in Thailand amounted to US Dollar 1468 million in electrical and electronic machineries. Among South-East Asian nations, during this period, Thailand's share in Japanese FDI in electronics was second only to China.

internationalization, followed by electrical and electronics machinery (assembled), electrical and electronics machinery (parts) and automobiles (parts)[12]. Other industries, showing reasonably high degree of internationalization are steel and financial services (banking and insurance). While industries like chemicals and telecommunications have also been internationalizing fast, global value chains with lead presence of Japanese firms are found to be most predominant in automobiles, electronics and financial services. Indeed, these are also the activities, where Japanese firms are showing increasing tendency of outsourcing operations to offshore vendors on efficiency grounds.

Value chain entry, of course, is somewhat influenced by country histories, in the sense that firms from countries already having presence in global production networks, are probably at a more advantageous position in securing new entries. In this regard, between Bangladesh, India, Sri Lanka, and Thailand, value chain presence, as of now, is seen to be highest for India, followed by Thailand, Sri Lanka and Bangladesh (Figure 1).

We now proceed to briefly outline the possibilities of firms from these four nations moving into Japanese value chains.

Figure 1: Value Chain Presence of Selected BIMSTEC Nations



Source: Global Competitiveness Report (2005-06)

India's Opportunities

Japanese business interest, in India, is on the upswing, primarily in automobiles, chemicals, and financial services[13], creating good scope for entry of Indian firms into value chains pertaining to these activities. Two factors are likely to facilitate this process. First, R&D capabilities of many Indian firms can help them secure offshore contract manufacturing and research jobs. Capable firms, obtaining such orders, can move into relatively higher ends of value chains. R&D-intensive high-end jobs in industries like automobiles or chemicals, - which are usually of the 'captive' type, - can create further scope for technology upgradation for integrating firms. Indeed, for firms possessing sound R&D capabilities, entering into 'captive' Japanese production networks, creates the possibility of sustained technological upgradation through a self-reinforcing *multiplier* process.

[12] See 'Japanese Foreign Direct Investment in the World Economy: 1951-1997', *Pacific Economic Papers*, No. 299, January 2000.
[13] See, Business Line (2005)

Second, Indian firms can also look forward to diverse IT-enabled opportunities as Japanese multinationals expand operations in financial services. Currently, many Indian firms are receiving outsourcing offers in design, programming, and testing, which are the more 'high-end' activities. Given the proven ability of Indian enterprises to adapt technology at firm-level, the increasing R&D initiatives of the corporate sector, and the wide availability of technically skilled professionals, Indian firms offer Japanese investors the opportunity of outsourcing both high-end as well as medium-end operations.

Thailand's Opportunities

Thailand's technology development trajectory presents a somewhat paradoxical scenario. The country appears to have relied more on mere expansion of ICT facilities, while ignoring development of know-why. As a result, while Thailand might appear to be more technologically 'ready' than other BIMSTEC nations, its ability to acquire dynamic competitive advantages through stronger innovative capacities seems quite limited. Thus, while moving into global value chains at relatively higher levels appears a distinct possibility for several Indian firms, such opportunities, at present, appear to be quite few for Thai firms. The heavy incidence of high-technology exports from Thailand clearly indicates that the country has achieved strong assembling capabilities. However, such capabilities, when viewed against the relative lack of innovative capacities, as well as low availability of technically skilled manpower, particularly in terms of scientific and engineering experts, underline Thailand's difficulties in pursuing advanced research for generating new technologies. Indeed, one might be tempted to conclude that R&D efforts at enterprise level in Thailand have mostly been restricted to implementation of imported technologies, rather than increasing absorptive and innovative capacities. These limitations may discourage Japanese lead firms from envisaging Thailand as a key location for outsourcing high value-added R&D-intensive functions. However, scope for moving into medium-end functions requiring relatively less advanced technical skills do exist for Thai firms.

Sri Lanka's Opportunities

Sri Lanka has a reasonably well-developed ICT infrastructure. Indeed, in some respects, Sri Lanka's ICT infrastructure is better than that of India's (e.g. in terms of number of cellular subscribers). On the other hand, in terms of innovation capacity and availability of scientists and engineers, Sri Lanka is better off than Thailand. In terms of global value chain presence as well, Sri Lanka is not much behind Thailand. It is evident that Sri Lanka does have some distinct technological advantages, which can be instrumental in facilitating greater entry of its firms into global chains. Sri Lanka's extant technological capabilities have largely been outcomes of 'home grown' efforts, given its low reliance on FDI as a source of advanced technology. It will not be surprising if Sri Lanka emerges as an attractive 'efficiency-seeking' destination for Japan.

Bangladesh's Opportunities

Bangladesh, unfortunately, appears to be lagging behind in most aspects of technological capabilities vis-à-vis India, Thailand and Sri Lanka. It's only distinct advantage is in availability of scientists and engineers. As of now, there appears to be little possibility of the advantage translating into a potent force for moving into global value chains. However, such scope might emerge if Bangladesh is able to upgrade the ability of its firms to absorb advanced know-how. While Japanese firms might not immediately start looking at the country with eager eyes, countries like India, can possibly view Bangladesh as an efficient location for carrying out less complicated functions at low costs.

5. Conclusions and Policy Agenda

Our study of technological capabilities in four select BIMSTEC nations underscores sharp heterogeneities in national technological endowments. While India and Thailand have taken significant strides in innovative capacities, and ICT-led hi-tech export assembling operations, respectively, Sri Lanka and Bangladesh, are yet to 'catch-up' technologically with these nations.

Our main objective in this paper was to study the possibility of industries from the four BIMSTEC nations moving into global supply chains coordinated by Japanese lead firms. In the previous section, we have outlined the scope of such possibilities. The possible scopes for entry into global chains have been delineated on the basis of the current positions occupied by the countries in their respective technological trajectories. However, augmentation of technological capabilities is certain to expand the scope of existing possibilities.

Entry into global chains contains considerable opportunities for learning through technological diffusion. However, more capable firms are able to 'learn' fast and move up the value chain quicker. Such mobility also depends on the institutional support made available by national country governments for improving firm-level capabilities. Greater state investment in expanding R&D resources of public institutions (i.e. state laboratories and scientific agencies), disseminating the output of scientific institutions for larger commercial applications, and improving institution-industry interface, will go a long-way in enhancing supply-side capabilities of local enterprises. Otherwise, 'learning' through global chains is likely to be ineffective and unlikely to facilitate 'high-end' movement.

Future technological effort aiming to enhance supply-side capabilities has to proceed in line with individual country requirements. India, for example, has to devote attention to penetration of its ICT infrastructure. Efforts in this regard should focus on making available ICT facilities at grass root level, primarily through spread of personal computers and expansion of Internet facilities through a bottom-up approach. Thailand's technology development agenda, on the other hand, needs to address the serious shortfalls in availability of human capital, which constrains its innovative capacities. Investment in R&D, both at government and corporate levels, accompanied by initiatives directed at improving quality of research in technical and scientific institutions should focus high on its list of priorities.

Both Sri Lanka and Bangladesh, which require a lot of technological 'catching up', must look forward to licensed technology and FDI, as core sources of capacity-building. Sri Lanka has already taken some interesting initiatives in the form of public-private partnerships for augmenting firm-level capabilities (Ramasamy, 2004). More such initiatives should be the order of the day. Indeed, for enhancing technological capabilities and upgrading local firms, both countries can consider adopting the cluster approach. Identifying selective clusters with global chain presence and providing them with an appropriate set of business development services (BDS), can help in effective technological upgradation. Bio-technology and marine products, for example, can be very useful sectors for Sri Lanka in this regard, while Bangladesh can consider its vast range of textile and jute products, for such upgradation.

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