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TECHNOLOGICAL 'CATCHING UP' IN BANGLADESH-EPZS: A PERFORMANCE APPRAISAL

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ABSTRACT

In view of the fact that East Asian economies extracted vast technological benefits adopting EPZ-strategies, an over-crowding as well as increasing variants of EPZs have mushroomed in the developing countries (DCs) such as Bangladesh over the years and produced a variety of empirical results. Although rewarding experiences with DC-EPZs in terms of inward foreign investment, employment generation and export promotion are often discussed in literature, the performance assessments of these EPZs in terms of reaping technological rewards such as backward linkages, product diversification and transfer of technology (TT), thus catching-up technological leaders, seem to be missing. In view of this shortcoming in the context of DCs, this study attempts to make a query about the overall technological orientations of DC-EPZs as well as their potentials of technological catching up adopting Bangladesh-EPZs (BEPZs) as a case study. In doing so, this study applies a number of assessment measures including the ones used by the Asian and Pacific Centre for Transfer of Technology (APCTT) using secondary industry-specific and country data from various government and non-government as well as local and international sources. The empirical examination of the industry distribution in BEPZs using four major propositions indicates that the degree of learning and catching up can be expected to be higher for fast-evolving EPZs like the ones observable in Bangladesh. The study ends with the recommendation of developing an ample amount of 'dated workforce' for the DCs like Bangladesh where EPZ-strategies may be carefully planned and pursued as technological kick-starter of their economies.

KEYWORDS
Export Processing Zones (EPZs), Technology Transfer, Catching-up, East Asia, Developing Countries.

INTRODUCTION

The past few decades have observed a progressive strengthening of international economic relationships and a growing integration of the world economy. The growth in FDI is the single most distinctive feature of globalization and, in turn, reflects the increasing importance of integrated, cross-border value-added activities of MNCs/TNCs. The surge in FDI-flows to developing countries (DCs) has been influenced by the liberalization of trade and investment regimes in many DCs (Henley and Kirkpatrick, 2001). EPZs seem to be well-fitted policy instruments for the attraction of FDI (Mauricio *et al.*, 1998). Among the pioneers, East Asian EPZs have distinctively emerged as an example to DCs of how "the existence of a functioning EPZ may accelerate the rate of technological progress in DCs" (Tyler and Negrete, 2009: 5). Being inspired by the East Asian success, an over-crowding as well as increasing variants of EPZs have mushroomed in the DCs such as Bangladesh over the years and produced a variety of empirical results[1]. Although Bangladesh's rewarding experiences with EPZs in terms of inward foreign investment, employment generation and export promotion (Bhattacharya, 1994) are often discussed in literature, the performance assessments of Bangladesh-EPZs (BEPZs) in terms of technological issues such as backward linkages, product diversification and transfer of technology (TT) seem to be missing. In consideration of all these views, this study aims to conduct an empirical examination of the BEPZs with the help of a number of measures including the ones used by the Asian and Pacific Centre for Transfer of Technology - APCTT (APCTT, 1986).

The study of the technological orientations of BEPZs can be considered important from the catching-up points of views. A catch-up economy has a clear objective to pursue, namely, to close the technological gap between itself and more technologically advanced countries. Abramovitz (1989) and Juma and Clark (2002) as well as the convergence hypothesis (Janne, 2006) suggest that followers tend to catch up faster if they are initially backward –"the larger the technological and, therefore, the productivity gap between the leader and the follower, the stronger the follower's potential for growth in productivity" (Abramovitz, 1989: 221). Bangladesh, initially being a technologically backward country, therefore has a great potential to narrow the technology gap with the leaders by pursuing economy-wide EPZ-strategy. The aim of this study, in this sense, to examine the *overall technological orientations of Bangladesh-EPZs (BEPZs) as well as their potentials of technological catching up* can be considered to be well-justified and empirically valuable.

In order to attain the above major objective, the following specific objectives will be accomplished:

1) To develop an overall understanding of the background, operational objectives of BEPZs and their links with the country's Technology Plans (section 3.0);
2) To study the proportion of capital- and labour-intensive firms in BEPZs, thus measure the trend with industrial diversification in BEPZ towards higher capital intensities (section 4.0);
3) To examine the level of linkages of EPZ-units with the local economy (section 5.0).

METHODOLOGICAL ISSUES

The difficulty with examining catching up activities of 'special technology infrastructures' (STIs)[2], eg, technology park (TP), export processing zone (EPZ) or Industrial Parks (IPs), is that there is no standard method for evaluating their success or failure. There is no established definition of success or a standard way to examine a company's effect on an economy (Drescher, 2001). While number of jobs and tax revenues generated usually remain to be the main focus, to ensure long-term success, a STI must focus on technology transfer (TT) and development of local technological capability (TC). The experience of Silicon Valley, for example, provides some insight into the mix of factors required for a successful STI and the culture and patience required to see long-term benefits (Wessner, 2009). Categorically, a range of studies that have attempted to determine success or failure of STIs tend to focus on benefits received by the economy or the community and by businesses located in the STIs. A group of researchers, such as Johnston (2001), are more positive suggesting that firms in STIs generally receive four basic benefits, and, thus assessment of these can present a performance picture of STIs:

1) A broadened understanding of mutual needs between university and industry researchers;

[1] (Basile and Germidis, 1984; World Bank, 1992; Jenkins et al, 1998)
[2] For a complete conceptual outlining of STI, refer to Sharif (2011).

2) Increased information and knowledge transfer;
3) Access to student workers, faculty consultants, laboratory, computer and other resources;
4) Increased business opportunities.

Many zones under investigation indicate that at least some job creation and economic diversification had been effected as a result of the development of the zone. Whether the job creation and tax revenues generated exceed the initial investment is a difficult question as many zones take several years to become profitable and attract a large number of tenants. Sometimes zones offer generous subsidies and tax incentives to attract business, adding to the initial expense. Sharif (2011) highlighted this approach of attracting business as short-term objectives which have no profound spillover effects on the economy. Therefore, while assessing the technical performance of EPZs, measuring the short-term benefits in an easy quantitative way cannot serve the ultimate purpose of measuring the extent of technology-oriented benefits from the zones. Other than these approaches, some other broad measurement activities are carried out currently at four levels – firm/department, inter-firm/inter-department, industry and regional/international – as used by the Asian and Pacific Centre for Transfer of Technology - APCTT (APCTT, 1986).

In order to accomplish the objectives of this study as well as to conduct the empirical examination and analysis, related secondary data will be obtained and compiled from various government- and non-government- statistical databases, publications, journals, organizational websites (eg BEPZA, IASP, etc.), books, etc. Following APCTT (1986) approaches partially, this study will make enquiries on technological catching-up performances of BEPZs from industry and regional/international points of view. To check the trend with the technological orientations, a scoring-based appraisal of the degree of diversifications of the industrial units in BEPZs will also be conducted.

AN OVERVIEW OF THE EPZS IN BANGLADESH

Within the evolving package of export-promotion measures targeted to augment private investment, particularly of foreign origin, the establishment of EPZs in Bangladesh occupies a conspicuous place. Under the 2nd Five Year Plan (2FYP), the government established the Bangladesh Export Processing Zone Authority (BEPZA) in 1983 through an Act of Parliament (Act. No. 36, 1980) to assign the responsibility of developing EPZs (APCTT, 1986). The act was however subsequently amended by two Ordinances in 1984 and 1988.

Under the aegis of the BEPZA, the two largest EPZs of the country in Chittagong and Dhaka were established in 1983 and 1993 respectively. Considering increasing demand of both local and foreign investors, the Government established eight more EPZs throughout the country: Comilla, Mongla (Khulna), Ishurdi, Adamjee (Narayanganj), among others. One EPZ that is being established in Comilla is well connected with the Chittagong sea port and the Zia International Airport by road and railway. Mongla EPZ is located in the southern part of the country, is well connected with the capital (Dhaka) by road and is only a few kms away from the country's second sea port (Mongla). Among the most recent ones, the EPZ in Adamjee is already in operation. Adamjee EPZ is located in Narayanganj (a historically prominent commercial district in Bangladesh), 15 kms from Dhaka city centers; 40 kms from Zia International Airport (Dhaka), 255 kms from Chittagong Port. In October 1996, the Government of Bangladesh enacted a law allowing the establishment of EPZs by the private sector. Taking advantage of the new provision, Youngone Corporation (Korea) set up the country's first *private EPZ* in Chittagong, namely Karnaphuli EPZ, which so far attracted a cumulative investment of $43.69 million from 2006 to April 2009 (BEPZA, 2009). Karnaphuli EPZ is located in North Potenga and Halishahar, within 6 Kms from Chittagong Port, 10 kms from main business center of Chittagong, 12 kms from Shah Amanat International Airport (Chittagong).

As studies, such as Aggarwal (2005), suggest that location of a zone in a development region and / or near strategic positions such as bigger cities, ports and airports affect both the investment and export competitiveness, it can be expected that BEPZs are in a position to enjoy locational advantages in attracting investment and gaining export competitiveness. The links of investment and export competitiveness with the technological progress will, however, be taken later in this study.

OBJECTIVES OF BANGLADESH-EPZS

The primary objectives of BEPZs, as outlined in the official website[3] of BEPZ Authority (BEPZA), is to provide special areas and treatments where potential investors would find a congenial investment climate, free from cumbersome procedures. The specific objectives are:

1) Promotion of foreign direct investment (FDI) and local investment;
2) Promotion and diversification of export and thus
3) Development of backward and forward linkages;
4) Generation of employment and thus upgradation of skill and development of management practices;
5) Transfer of technology (and knowledge).

The continuing relevance of EPZs in Bangladesh possibly lies in the country's effort to address the structural impediments which inhibit the inflow of FDI. With the crumbling of the tariff wall in the Bangladesh economy, the temptation of foreign investors to produce for a captive domestic market no longer exists. Understandably, future FDI in the country will essentially flow to industries producing for overseas markets. However, it is well recognized that the absence of adequate infrastructural facilities constitutes one of the main factors which deter the inflow of foreign capital. The EPZs, as one form of special technology infrastructure (STI) of the country, are expected, therefore, to offer the best package available in the country in terms of well-equipped industrial sites, and related commercial and financial services and facilities.

LINK OF BEPZ-OBJECTIVES WITH TECHNOLOGY PLANS

Growth theories and the study of STI-schemes do highlight the importance of government intervention for inducing technical progress in a DC (Sharif, 2011). Therefore, prior to the assessment of the EPZ, this section examines the 2nd Five Year Plan (2FYP) and the National S&T plan (NSTP), both of which were formulated in the same year, 1980. NSTP aimed at ensuring transfer and utilization of research results in industries, generate internationally competitive technology, develop modern support facilities and provide support to emerging technologies, like, biotechnology, genetic engineering, micro-electronics, etc. The NSTP recognizes that the integration of scientific and technological considerations into the overall development strategy of the country should be a national priority. One sub-section of the NSTP (1986) deals with the –

"establishment of a national capability for development of indigenous technology, and attainment of a national capacity for the assessment, selection, acquisition, adoption and adaptation of foreign technology" (p. 22).

In line with the above recognition and with the fulfilment of the primary objectives of developing and transferring technology efficiently, the NSTP aimed strategically to:

BOX 1.0: SIMILARITY BETWEEN NSTP-AIMS AND TP-FEATURES

a. Ensure the transfer and utilization of results of research in production sectors of the national economy;
b. Ensure the establishment of institutional facilities for relevant knowledge assimilation and skill development for the learning-adsorption process on imported technology;
c. Ensure the provision of facilities for transfer and productive utilization of research results through the institutionalization of engineering design, prototype development and commercialization of products in the relevant sector corporations and individual units in both public and private enterprises;
d. Generate the technologies which are internationally competitive, particularly those with high export potential;
e. Ensure the development of support facilities like information and documentation services, computer services and software packages, standardization and quality control;
f. Provide support to emerging technologies like biotechnology, genetic engineering, micro-electronics, new and renewable sources of energy and so forth.

Source: Author's own scrutiny on literature

[3] Source: http://www.epzbangladesh.org.bd as on 28 December 2010.

Since the NSTP formulated aims having strong similarity with Technology Park (TP) features and, moreover, the 2nd FYP envisaged technology and export-promotion through establishing Export Processing Zones (EPZs), it can be said that similarity exists between the features of the TP (Sharif, 2011) and the objectives of the NSTP of Bangladesh. Although the national technology assessment in Sharif (2011) showed no practical implications of the NSTP objectives in the economy of Bangladesh, these objectives are mostly reflected by the policy declarations of the second five year plan (2FYP) under which EPZ was enacted. Therefore, it is expected in this study that NSTP-objectives would be reflected in the operational activities of EPZ as well as in the selection of industries while allocating spaces in EPZs. In consideration of this expected linkage between NSTP and EPZ-objectives, this study applies a number of measures to assess the technological performances of the BEPZs and, thus, assess, *to what extent can the EPZs facilitate catching up possibility for Bangladesh?*

INDUSTRY DISTRIBUTION OF EPZ-FIRMS

The international product cycle operates in a manner whereby countries over time transit from the production of lower technology goods to higher technology goods. The main purpose of this section is to examine whether industrial operations in BEPZs have experienced a transition from labour-intensive assembly to more complex and capital-intensive products. As Brautigam (2007:1) argued, when a country moves from simple assembly to more complex products, it indicates that the country is moving up the 'learning curve' (refer to technology S-curve, Sharif, 2011). The sectoral orientation of EPZs has therefore been argued to have a great influence on the transfer of technology (TT) and skills. Amirhamdi and Wu (1995) cited the example of Masan EPZ (South Korea) where electronics and chemical industries were predominant. The industries most likely to involve TT are listed to be those producing capital and intermediate goods, such as electrical equipment, industrial chemicals, metallurgy, and rubber -- industries that normally require a high level of investment.

Sharif (2011) made an in-depth study of the inherent features of the world-EPZs and presented a comparative picture between the zones of East Asia and those of the DCs. In most cases, it was found that a single industry accounts for more than 40% of total EPZ activity. Electronics prevail in East Asia (Korea, Malaysia and Taiwan) and Mexico, while textile and garments dominate in the DCs. Rabbani (1980), and Cling and Letilly (2001) explained the reasons for East Asia's strategic emphasis on electronics by a number of factors:

1) higher relative capital intensity,
2) product dynamism,
3) aggressive international marketing (facilitating forward linkage),
4) high level of -product sophistication and -development of the country.

In line with the above observation and the empirical findings in Rabbani (1980), Cling & Letilly (2001) and Sharif (2011), this section develops four *propositions* to make an assessment of the current industry distribution and its trend in Bangladesh-EPZs (BEPZs) over the years. The propositions are as follows:

BOX 2.0: PROPOSITIONS OF THE STUDY

Proposition 1:	The more likely industries are labor-intensive lightweight manufactures (thus facilitating transfers of little complex or simple technologies only).
Proposition 2:	A single category of industries dominates EPZ-activity in Bangladesh.
Proposition 3:	The dominating industry is overwhelmingly dominant over the years. This hypothesis is inspired by Roberts' observation (1992) that: "…once a particular industry begins to dominate activity in an EPZ, it tends to become overwhelmingly dominant" (cited in Jenkins et al., 1998: 21)
Proposition 4:	Capital-intensive industries (or industries with high level of investment) result in higher rate of returns.

Source: Formulated on the basis of literature review

In order to examine the validity of the above propositions, Table 2.0 is constructed to highlight an overview of Bangladesh EPZs in terms of *capital intensity* (or amount of investment made) of firms and *industry distribution*. Examining 'capital intensity' is considered important in this study in light of Gu's observation (2000) on Taiwan and Korea that high level of capital investment is a critical factor for rapid catching-up. As Scherer (1992) explained 'product diversification' as the mechanism for increasing returns to capital (and to learning), checking yearly 'industry distribution' is also deemed necessary here. As Gu (2000) argued, the increasing returns come from a temporary innovation rent (associated with product diversification) which (1) augments qualitatively the returns to their investment in physical and human capital, and (2) creates a monopolistic competitive advantage to the latecomer. In the earlier literature, new and dynamic industries were argued as the opener of more technology opportunity than traditional industry (Liu, 2007). For this reason, in earlier literature, from Gerschenkron (1962) and onwards, targeting new industry as a strategy to give latecomer country a good opportunity to catching-up was emphasized. Also, empirically, researchers found the catching-up of the Asian NIEs such as Taiwan and Singapore to be fastened by targeting new industry (Liu, 2007).

In light of Aggarwal's (2005) argument that composition of economic activities in the zones such as clustering and capital intensity also affect the export competitiveness, proposition four will therefore be verified through the construction of Table 5.0 using export data besides investment and employment data. In Table 5.0, export earnings will be used as a proxy of rate of return due to unavailability of empirical data on firms' rate of return - the way Ohanian and Wright (2007) used 'export earnings' to research rate of return from capital flows for 200 countries between 1950 and 2005. Export data has been also important here in the sense that, besides government's strong emphasis on targeting new industry, the higher export-orientations played key role in the catching-up process of the newly emerging economy, such as Taiwan and Singapore (Liu, 2007).

EXAMINING PROPOSITIONS 1-3

From the computed data in Table 2.0, the first three propositions can be verified as follows:

1) Bangladesh-EPZs (BEPZs) are dominated mostly by labor-intensive industries such as garments, knitting, terry towel, caps, tent, which belong to 'textile and garments' (T&G) category.

2) At the initial stage of EPZ-operation in Bangladesh (the second EPZ emerged in 1993), the industry concentration reflected the typical EPZ-picture of the DCs with 81% T&Gs. There is no doubt that the EPZs were dominant by the overcrowding number of T&Gs.

TABLE 2.0: YEARLY INDUSTRY DISTRIBUTION OF BANGLADESH EPZ

Major Category of Industries	Capital Intensity per employee * (in US$)			Yearly distribution of industries in EPZs (number of industries in percentages)			
	2003	2006	2009	1986	1997	2003	2009
Textiles and Garments	4,910	5,254	5,540	81.0	64.2	51.0	52.2
Electric and Electronic	14,182	22,794	25,414	1.0	9.5	16.0	16.2
Footwear and Leather	8,916	6,562	6,629	0.0	4.2	8.0	4.4
Heavy Engineering	34,047	37,546	39,364	15.0	15.4	16.0	16.4
Service-oriented industries	N/A	10,878	12,372	N/A	N/A	2.2(b)	1.0
Agro products	N/A	9,509	12,424	N/A	N/A	1.1(b)	2.3
Miscellaneous				3.0	6.8(a)	5.7	7.5
Total				100.0	100.0	100.0	100.0

***Notes**: (a) Includes furniture manufacturing (1.1%); paper products (2.1%); plastic materials (2.1%) and sports items and toys. (b) New additions in the list; N/A: Not available.*
** Capital intensity per employee = Total investment (cumulative) ÷ Total no. of employees*
***Sources**: Bangladesh Export Processing Zones Authority (BEPZA).*

3) By 2003, the proportion of 'electrical and electronic' (E&E) goods jumped to a higher level steadily from 1% industrial share in 1986 to 16.2% share in 2009. T&Gs, on the other hand, experienced drastic fall of their shares in total number of industries, from a substantial share (81%) in 1986 to nearly half (52.2% share) in 2009. The share of heavy engineering is also on the rise. The continuous growth of the capital-intensive industries proves that:

a) the initially dominant T&Gs could not hold their dominance in the EPZs; (thus)
b) Roberts' proposition (1992) does not appear to be valid in cases of Bangladesh-EPZs.

Since the investment per employee in E&Es (nearly $21,000 in average) and heavy engineering (nearly $37,000 in average) shows much higher capital-intensity of these firms as compared to the others, it can be deduced that:

a) Bangladesh-EPZs (BEPZs) are becoming '*less footloose*' in nature indicating greater permanence of foreign investment in the zones;
b) BEPZs have created great opportunity of fast catching up (refer to Gu's observation, 2000).

EXAMINING PROPOSITION 4

The broad association between GDP per capita and technology indicators is confirmed in literature in numerous occasions (Sharif, 2011). The association however has changed over time and a variety of national patterns has come into existence. As Pianta (1995) argued, most countries have experienced strong growth by making a balanced use of a couple of 'engines of growth' offered by technology:

1. disembodied innovative activity (proxied by R&D intensity)
2. technology embodied in investment (proxied by capital formation per employee).

In a similar fashion to Pianta (1995), UNU (2011) explained technological change as a unidirectional advance from a low to a high technology by a set of indicators such as capital intensity, expenditures for R&D, and sophistication of engineering and design. Sharif (2011) used R&D intensity as a proxy to check innovative activity in Bangladesh and then cross-check with some selected country experiences. Checking R&D intensity (and sophistication of engineering and design as well) in case of Bangladesh-EPZs in this study however appears to be difficult due to unavailability of firm-specific data.

In an attempt to compare and contrast the different firms' performance, Migdad (2002) used two technology indicators of firms:

1) cost per job creation (CJC) or capital intensity (K/L)
2) growth of employment (GE).

Data on capital formation (Pianta, 1995) in order to calculate capital intensity (Migdad, 2002; UNU, 2011) of the BEPZ-firms is not readily available for collection. As a partial fulfilment, technology embodiment in investment is therefore examined here by calculating yearly investments per worker at the firm levels. In line with Migdad (2002), Tables 3.0 and 4.0 are constructed to present 'investments per worker' and 'number of workers per firm' and thus make an assessment of the degree of technological attainments of BEPZ-firms during 2002-2011.

In Table 3.0, 'heavy engineering firms' appear to have consistently ranked number 1 position over nine years due to deployment of the highest investments per worker. E&E, although ranked in between 3 and 5 during 2002-08, continued to rank 2 from 2008-09. Garments, generally being one of the most populous industry in terms number of workers employed, have persistently ranked the lowest (ie, 15) since 2003-04. Plastic products ranked number 2 for a few years (2003-07) and then started losing its dominance among the list of countries since 2007-08 due to poor investments per worker. Among all, service-oriented industries have displayed some interesting pattern by staying in the middle of the Table (ranks 7-8) for six consecutive years and then start slowly rising to rank 3 in 2010-11 through rank 5 in 2009-10. In terms of diversity in the mix of industries in BEPZs, it can be said that Bangladesh has shown some success in attracting FDIs in:

1) highly capital-intensive industries such as heavy engineering, electronics, etc.; and
2) new types of industries such as agro products and service-oriented industries since 2003-04.

It is important to note that investment per worker can be calculated to be high (or low) as a result of the simultaneous presence of very high (very low) volumes of yearly investments as well as bulk (low) employment. It order to check this possibility and thus develop greater conceptual clarity about the intensity of investments per worker (as in Table 3.0) in genuine sense, 'number of workers per firm' is calculated and presented in Table 4.0.

TABLE 3.0: INDUSTRY-WISE INVESTMENT PER WORKER (IN USD), BEPZS, 2002-03 TO 2010-11

Category of Industry (in alphabetical order)	I	II	III	IV	V	VI	VII	VIII	IX
	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Agro product	N/A	4,818 (11)	14,898 (04)	9,509 (09)	22,422 (03)	13,213 (06)	12,424 (06)	13,080 (06)	17,608 (06)
Caps	2,955 (10)	3,194 (13)	3,401 (14)	3,454 (14)	4,453 (14)	5,589 (13)	6,714 (11)	6,364 (12)	6,367 (12)
Electrical & electronics	14,182 (04)	17,095 (03)	17,204 (03)	17,707 (03)	16,135 (05)	17,405 (04)	25,414 (02)	24,333 (02)	20,998 (02)
Footwear & leather	8,916 (06)	9,139 (08)	10,183 (09)	9,889 (08)	8,392 (09)	7,599 (09)	6,629 (12)	6,807 (11)	6,576 (11)
Garment accessories	15,866 (02)	14,611 (05)	14,439 (05)	13,097 (05)	15,895 (06)	17,858 (03)	16,470 (04)	18,450 (04)	17,824 (05)
Garments	2,248 (12)	2,803 (15)	2,729 (15)	2,646 (15)	2,592 (15)	3,321 (15)	3,394 (15)	3,478 (15)	3,508 (15)
Heavy Engineering (a)	34,047 (01)	26,492 (01)	27,807 (01)	37,546 (01)	35,128 (01)	26,974 (01)	39,364 (01)	33,889 (01)	32,117 (01)
Knitting	2,474 (11)	3,132 (14)	4,850 (12)	4,558 (12)	5,024 (12)	5,052 (14)	5,488 (14)	5,580 (13)	5,578 (14)
Plastic products	8,889 (07)	17,890 (02)	18,270 (02)	20,547 (02)	25,039 (02)	9,248 (08)	10,047 (08)	9,113 (09)	8,634 (09)
Paper products	6,726 (08)	8,117 (09)	8,719 (10)	7,625 (10)	6,751 (10)	7,320 (11)	7,324 (10)	12,248 (08)	12,248 (07)
Ropes	15,271 (03)	15,835 (04)	13,815 (06)	14,963 (04)	16,271 (04)	13,513 (05)	13,368 (05)	12,528 (07)	9,680 (08)
Service-oriented	N/A	10,927 (07)	11,168 (08)	10,878 (07)	11,575 (08)	12,119 (07)	12,372 (07)	17,698 (05)	19,471 (03)
Tent	2,148 (13)	3,256 (12)	4,028 (13)	4,481 (13)	4,865 (13)	6,845 (12)	5,964 (13)	5,284 (14)	5,580 (13)
Terry towel	3,952 (09)	5,164 (10)	6,312 (11)	7,793 (11)	6,636 (11)	7,404 (10)	7,927 (09)	7,998 (10)	8,168 (10)
Textiles	10,968 (05)	11,980 (06)	11,622 (07)	11,828 (06)	12,839 (07)	18,522 (02)	18,886 (03)	19,223 (03)	19,334 (04)

Source: Author's own calculations based on the BEPZA data.

Notes: N/A – not available;
The numbers in parentheses in columns I-IX indicate industries' rank (rank 1 – highest investment/worker and 15 – the lowest investment/worker).
(a) Heavy engineering now includes chemical production, partial automobile manufacturing for Nissan, Mitsubishi, and Hino, and mobile phone manufacturing for Sony.

In Table 4.0, 'garments', as assumed, have mostly ranked the lowest (ie, 15) in between 2003-11 employing highest number of workers per firm. 'Heavy engineering firms' appear to have ranked in between 3 and 5 over nine years due to relatively low employment per firm. E&E has mostly ranked 6 during 2002-11. Plastic products ranked number 2-3 for a few years (2003-07) and then started dropping in the list for being an employer of relatively higher number of workers since 2007-08. Paper products which occupied variably lower ranks between 7 and 11 in terms of investments per worker (Table 3.0) have ranked in terms of workers employed per firm the top in 2002-03 and 2003-04, and consistently ranked 2 since 2004-05. Among all, agro-products have displayed a significant pattern by topping the list of industries just from the second year of its emergence in the BEPZs' industry list since 2002-03.

From Tables 3.0 and 4.0, the following findings can be considered to be the major ones:

1) Heavy engineering and electrical and electronics (E&E) industries are highly capital-intensive – a good sign of high technical orientation in BEPZs (Table 3.0);
2) Agro products and paper products are capital-intensive in the sense that these industries require very few workers as compared to other industries located in BEPZs (Table 4.0);
3) Garments, knitting, tent and caps are relatively less capital intensive due to the fact that investment per worker in these industries have been one of the lowest among all (Table 3.0) and workers employed (per firm) have been relatively higher than others (Table 4.0).

TABLE 4.0: WORKERS PER FIRM, BEPZS, 2002-03 TO 2010-11

Category of Industry (in alphabetical order)	I	II	III	IV	V	VI	VII	VIII	IX
	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Agro product	N/A	72 (02)	19 (01)	30 (01)	14 (01)	34 (01)	27 (01)	36 (01)	26 (01)
Caps	1327 (12)	1519 (14)	1590 (14)	1784 (13)	1535 (13)	1140 (14)	1098 (14)	1090 (14)	1126 (13)
Electrical & electronics	181 (06)	234 (08)	238 (08)	194 (06)	205 (06)	210 (06)	190 (06)	214 (06)	250 (07)
Footwear & leather	363 (08)	411 (10)	411 (10)	433 (09)	523 (09)	606 (11)	731 (11)	881 (11)	887 (11)
Garment accessories	83 (02)	135 (06)	169 (06)	194 (06)	241 (07)	254 (08)	238 (08)	198 (05)	214 (05)
Garments	1469 (13)	1681 (15)	1953 (15)	1953 (14)	1945 (14)	1820 (15)	1853 (15)	1888 (15)	1906 (15)
Heavy Engineering(a)	127 (04)	127 (05)	149 (05)	116 (04)	126 (03)	158 (03)	146 (03)	133 (03)	151 (04)
Knitting	1126 (10)	1114 (12)	815 (12)	925 (11)	895 (11)	1007 (13)	834 (12)	922 (12)	984 (12)
Paper products	57 (01)	47 (01)	45 (02)	55 (02)	62 (02)	58 (02)	58 (02)	53 (02)	53 (02)
Plastic products	112 (03)	95 (03)	89 (03)	79 (03)	62 (02)	178 (05)	166 (04)	217 (07)	231 (06)
Ropes	139 (05)	186 (07)	215 (07)	205 (07)	190 (05)	228 (07)	229 (07)	256 (08)	335 (08)
Service-oriented	N/A	97 (04)	103 (04)	151 (05)	157 (04)	174 (04)	181 (05)	173 (04)	144 (03)
Tent	1296 (11)	1446 (13)	1351 (13)	1267 (12)	976 (12)	1003 (12)	1039 (13)	1015 (13)	1181 (14)
Terry towel	321 (07)	324 (09)	294 (09)	277 (08)	364 (08)	366 (09)	416 (09)	421 (09)	423 (09)
Textiles	660 (09)	735 (11)	712 (11)	791 (10)	794 (10)	599 (10)	564 (10)	605 (10)	558 (10)

Source: Author's own calculations based on the BEPZA data.

Note: N/A – not available;

The numbers in parentheses in columns I - IX indicate industries' rank (rank 1 – lowest no. of workers; 15 – the highest number of workers).

Now, as a combination of the observations from Tables 2.0, 3.0 and 4.0, it can be concluded that BEPZs have experienced higher technical orientations by accommodating more capital-intensive and relatively less labour-dependent firms (eg, heavy engineering and E&E) and showing greater diversifications in industry mix with inclusion of agro-products – an industry consistently ranking number 1 for being the lowest employment provider and relatively more capital-intensive in nature.

However, although an attempt is made above to draw an analytical conclusion about EPZ-based industries' comparative capital intensity (as a proxy of technical orientation) by examining degree of investment per worker and employment per firm on the basis of industry-specific yearly data from BEPZA, the overall outcome of the analysis from Tables 3.0 and 4.0 has appeared to be somewhat clumsy and complex. Due to this reason, in order to make a systematic analysis of the performance of industries in BEPZ in terms of technical orientation and rate of return, Table 5.0 is constructed where technical orientation is measured via *investment per worker* (Table 3.0) and *workers per firm* (Table 4.0), and rate of return (ROR) or return on investment (ROI) is measured via *average export earnings per worker*. As in management studies, scoring and ranking systems are considered to be extremely valuable tools to predict the future, make decisions, and improve behavior – sometimes all of the above (Yates, 2009), this part of the research has made use of this tool to rank industry performances on the basis of *investment per worker*, *workers per firm* and *average export earnings per worker* in order to deal with the fourth proposition of this study.

Experiences of the successful East Asian zones show that firms with higher capital intensity per worker reflect the following features (Sharif, 2011):

- less footloose in nature;
- high technology orientation;
- higher export earning; and
- lower employment relative to labour-intensive firms.

Additionally, it is also important to take into account that higher capital intensity and higher export earnings may be assumed to represent a large firm in size or may lead a firm to be large in course of time with higher capital intensity (Vermuelen, 2004; Jauhari, 2009). Now, if the firm in consideration is large (eg, heavy engineering, as observable in Table 3.0), the empirical findings on size in terms of capital intensity, export generation, etc. would be consistent with two technology-related arguments:

First, large firms may benefit from economies of scale in the adoption of new technology and have more capacity to finance technology adoption in imperfect financial market settings (Cohen and Klepper, 1996).

Second, the economies of scale from which large firms benefit allow them to operate with a more efficient division of labour resulting in better conditions for mechanization and technological upgrade (Correa *et al.*, 2008).

In line with the observations made on the successful East Asian zones in Sharif (2011), Table 5.0 ranks the firms on the basis of:

(a) level of capital intensity per worker (columns I, II and III),
(b) workers per firm (columns IV, V and VI), and
(c) potential for generating greater export earnings (columns VII, VIII and IX).

The scores are assigned and the final industry performance-ranks are calculated in Table 5.0 in the following ways:

Score 13 for highest capital intensity per worker and 1 for the lowest;
Score 13 for lowest employment (ie, indicator of more capital-intensity) and
1 for the highest (ie, indicator of more labour-intensity in firms)
Score 13 for highest export earning per worker and 1 for the lowest ones
Thus,
Rank 1 for the highest total scores (columns X, XI and XII).

TABLE 5.0: INDUSTRY PERFORMANCE ON THE BASIS OF CAPITAL INTENSITY AND AVERAGE EXPORTS, 2002-03, 2005-06 AND 2008-09

Category of Industry (in alphabetical order)	Investment per worker (Scores)			Workers per firm (Scores)			Exports per worker in million US$ (Scores)			Rank (Scores)		
	I	II	III	IV	V	VI	VII	VIII	IX	*2002-03*	*2005-06*	*2008-09*
	2002-03	2005-06	2008-09	2002-03	2005-06	2008-09	2002-03	2005-06	2008-09	X = I+IV+VII	XI = II+V+VIII	XII = III+VI+IX
Caps	2,955(04)	3,454(02)	5,651(03)	1327(03)	1784(02)	1098(02)	0.008(07)	0.011(07)	0.013(09)	9(13)	11(11)	9(14)
Electrical & electronics	14,182(10)	17,707(11)	2,794(12)	181(09)	194(09)	190(10)	0.013(11)	0.013(09)	0.012(08)	3(29)	2(30)	2(30)
Footwear & leather	8,916(08)	9,889(07)	6,562(05)	363(07)	433(06)	731(05)	0.006(05)	0.008(05)	0.009(06)	6(20)	7(18)	8(16)
Garment accessories	15,866(12)	13,097(09)	16,625(10)	83(12)	194(09)	238(08)	0.010(08)	0.016(11)	0.022(11)	2(32)	3(29)	3(29)
Garments	2,248(02)	2,646(01)	3,369(01)	1469(02)	1953(01)	1853(01)	0.008(06)	0.008(05)	0.008(05)	10(10)	12(07)	11(07)
(a)Heavy Engineering	34,047(13)	37,546(13)	39,364(13)	127(10)	116(10)	146(12)	0.118(13)	0.105(13)	0.083(13)	1(36)	1(36)	1(38)
Knitting	2,474(03)	4,558(04)	5,934(04)	1126(05)	925(04)	834(04)	0.006(05)	0.007(04)	0.009(06)	9(13)	10(12)	9(14)
Plastic products	8,889(07)	20,547(12)	9,686(08)	112(11)	55(12)	166(11)	0.011(10)	0.010(06)	0.009(06)	4(27)	2(30)	6(25)
Paper products	6,726(06)	7,625(05)	7,319(06)	57(13)	79(11)	58(13)	0.009(08)	0.010(06)	0.011(07)	5(26)	6(22)	5(26)
Ropes	15,271(11)	14,963(10)	3,689(09)	139(10)	205(08)	229(09)	0.010(09)	0.014(10)	0.018(10)	3(29)	4(28)	4(28)
Tent	2,148(01)	4,481(03)	5,578(02)	1296(04)	1267(03)	1039(03)	0.013(11)	0.012(08)	0.012(08)	8(16)	9(14)	10(13)
Terry towel	3,952(05)	7,793(06)	8,126(07)	321(08)	277(07)	416(07)	0.004(05)	0.007(04)	0.009(06)	7(17)	8(17)	7(20)
Textiles	10,968(09)	11,828(08)	9,127(11)	660(06)	791(05)	564(06)	0.014(12)	0.019(12)	0.024(12)	4(27)	5(25)	3(29)

Source: Author's own calculations based on the BEPZA data.

Note: The figures in parentheses in columns I - XII indicate industries' total scores;

(a) now includes chemical production, partial automobile manufacturing for Nissan, Mitsubishi and Hino, and mobile manufacturing for Sony.

Since the number of capital-intensive units is calculated to be increasing at a consistent rate (see Table 2.0) in the EPZs, it can be said that Bangladesh possesses higher chances of *technical capability* (TC)-building opportunities with higher export potential. In support of this observation, Table 5.0 now shows a very promising picture for the EPZs of Bangladesh (BEPZs).

Columns X - XII of Table 5.0 highlight that *Heavy engineering firms* rank the top due to (uncomparably) the highest capital intensity, reasonably low employment and its performance as the highest export earner in all three fiscal years, 2002-03, 2005-06 and 2008-09.

Electrical and electronics (E&E), although rank 3 in 2002-03 move up to position 2 in 2005-06 and continue to hold the position in 2008-09 due to increasingly higher capital intensities than the one in 2002-03.

Among the textile and garments (T&G) category of industries, 'garment accessories' and 'ropes' rank 2 and 3 respectively in 2002-03. Although T&Gs are labour-intensive in nature, Table 5.0 shows high capital intensity and low labour intensity of the above firms, thus higher ranks.

Garment accessories although having relatively higher investment and higher exports in 2002-03, plunge one step down to rank 4 in both 2005-06 and 2008-09 due to increasingly higher levels of employment than in 2002-03. *Electrical and electronics (E&E)* now take over Garment accessories' previous rank (2) in 2005-06 and continue to hold it until 2008-09.

Textiles, although plunged one rank down to 5 due to higher employment per firm and relatively lower investment per worker than other industries in year 2005-06, have jumped two places up to rank 3 by almost doubling the investment (of 2002-03) and lowering employment with steady increase in exports in 2005-06 and then in 2008-09.

Garments generally being less capital-intensive and more labour-intensive score low and thus rank the lowest among all the industries in BEPZs in all three years of this study.

Although agro products and service-oriented industries display promising character in terms of investment per worker and workers per firm, these industries have not been brought under consideration in Table 5.0 due to their emergence in BEPZs after 2002-03.

The empirical observation now verifies the **fourth proposition** of this section with the observation that 'higher capital intensity' resulted in higher rate of returns (ie, proxied by export earnings) for BEPZs. Only capital-intensive firms that show higher rate of return in terms of export-earnings are the 'heavy engineering' units followed recently by E&E firms.

Literature reviews show EPZs as a continually evolving phenomenon (see dynamic life cycle, as proposed in Sharif, 2011). In their infancy, EPZs are human capital based with very little spillover effects to the local economy in terms of foreign exchange earnings, and employment income. The story of Taiwan's EPZ (Kaoshiung) is a good example of how the inherent self-reliant nature of EPZ can be countered to convert EPZs into a catalyst for growth. As observed in cases of DCs, foreign investment initially also came in Taiwan for labour intensive, light industries, eg, textile. The country then offered special incentives to successfully attract capital intensive industries such as machinery, steel, petrochemicals, thus making the type of information (refer to the 'second wave of learning' in East Asia, Sharif, 2011) and technology transfer they were seeking possible (for details, see Wood-Kouassi, 2007).

The East Asian success stories as outlined above indicates that the zones shift to more technology-intensive industries as a country develops and moves up along the technological learning curve (Sharif, 2011). Manufacturing-oriented zones in this process can be re-oriented toward other industries over time such as service industries (Amirhamdi and Wu, 1995). In consideration of these views, an examination of the list of recent enterprises, export data, investments, etc. indicates that Bangladesh-EPZs (BEPZs) have been increasingly able to attract and facilitate:

- non-traditional manufacturings, and
- capital-intensive industries.

Warr (1989) and Rhee & Belot (1990) identified EPZs as one of several possible factors helping DCs to increase non-traditional exports. Radelet (1999) in this connection used the experience of the original four Asian NIEs (Hong Kong, Singapore, South Korea, Taiwan) to provide empirical support for this argument. Among non-traditional industries, examples of agro product- and service-oriented- industries in this study come forth – two fast growing industries in BEPZs. The emergence and growth of these industries indicate the diversifying capability of the BEPZs.

Certain structural transformations take place within a country's EPZ as the economy develops and diversifies. Transformation towards more capital-intensity in industries is one of them. For example, Xie's (2000: 152) observation can be noted in this regard:

"Rapid growth, technological learning, and the absorption of new technology combined can alter relative factor endowments."

BEPZs have also attracted a number of capital-intensive industries in recent years (Sharif, 2011). The following developments can be cited as some obvious examples of these kinds:

1. the chemical production;
2. mobile manufacturing for Sony,
3. partial automobile manufacturing operations for renowned companies such as Nissan, Mitsubishi, and Hino.

Diversifying into automobile-related industry can be treated as progression to industries with more advanced technology that involve more sophisticated local technology and create more local value-added (Omar and Stoever, 2008). Increasing imports by above companies also indicate technological sophistication of

BEPZ's auto parts production. Szamosszegi (2007) used similar kinds of evidences of technological sophistications in the Chinese EPZs (eg, Suzhou Industrial Park) that are increasingly becoming home to substantial amount of foreign investments from parts producers, including Delphi. Most recently, Chrysler has jumped on the bandwagon by transferring their plant operations to China (Wood-Kouassi, 2007). The levels of technological development and production capacity that exist in China today did not develop internally. As Thun (2004) noted:

"Once in China, GM and other US automakers provided technology and know-how to upgrade the Chinese parts and vehicle industries. Soon after, these companies began using Chinese-produced parts instead of US parts in their China-produced vehicles. After that, they began using Chinese parts in their US vehicle assembly operations". (p. 85)

In light of these empirical observations, it can now be deduced that that Bangladesh-EPZs (BEPZs) have created some opportunities of technology transfer (TT) by growingly accommodating operations of capital-intensive productions (eg, auto parts manufacturing). In order to strengthen this process and create more spillover-benefits of TT in the local economy, endogenous technological capability (TC) needs to be improved so that the country can adopt a superior method of TT (Sharif, 2011). Recalling the importance of the concept of 'dated labour' as postulated in vintage models (Sharif, 2011) can be of use here.

LINKAGE EFFECTS OF BANGLADESH EPZs (BEPZs)

Experience shows that the success of EPZs will depend on the extent to which these zones are integrated with their host economies through backward and forward linkages, the transparency and responsiveness of the regulatory framework, as well as infrastructural efficiency (Omar and Stoever, 2008). Sharif (2011) highlighted the importance the Korean government laid on linkage effects and promotion of local components (vertical policies) and the Taiwanese government's emphasis on market-augmenting policies (horizontal policies) towards developing their technological infrastructure (TI). Omar and Stoever (2008:155) argued that EPZs' success must reflect:

"… deepening of the zones' linkages with the host economy and of the technological sophistification of the inputs purchased by companies in the zones from local suppliers."

The transfer of technology (TT) and linkage creation associated with the EPZs appear difficult to sort out (Leinbach, 1982). The linkages and externalities generated vary according to the stage of industrialization and the product cycle, availability of skills and entrepreneurship, the market for the product, and the efficiency of government institutions (Lall, 1978; Karunaratne, 1980). In light of these views, the linkage effects of the BEPZs can be perceived from two angles:

first, in terms of their interface with the global economy (forward linkage), and

second, in terms of the level of their integration with the local economy (backward linkage).

Section 5.1 examines, in connection with the first set of linkages, the performance of the zones as regards *foreign trade* and *technology transfers (TT)*. Job creation by the zones and other issues relating to flow of goods and services from the domestic tariff area (DTA) to the EPZs are examined, with reference to the level of integration of the zones in the domestic economy. The latter factor (ie, regulatory framework, as well as infrastructural efficiency) will however be taken up in later part of the study.

FORWARD LINKAGE (FOREIGN TRADE)

A total trade worth $400 billion is done through the operations of over 3,000 EPZs or similar Zones around the world (World Bank, 2009). In a similar way, one of the major attractions for countries like Bangladesh, which especially face foreign exchange shortages, is the export earnings by the EPZ-units. In 1995-96, BEPZs accounted for more than 11% of the national export receipts and their net contribution to the balance of payment (BOP) was to the tune of 0.20% of GDP. Their contribution in both spheres has been on the rise in recent years. Table 6.0 provides information on forward linkages of BEPZs in terms of their contributions in national exports, 1990-2008.

TABLE 6.0 TRENDS IN EXPORTS BY ENTERPRISES IN THE EPZS AND IN BANGLADESH, 1990-2008

Year	Exports ($m) from all EPZs	Yearly growth rates of EPZ-Exports	Bangladesh- Exports ($m)	Growth rates of Bangladesh-Exports	EPZ-exports as % of Bangladesh-Exports
1990-91	47.99	40.32%	1200.00	23.97%	4.00%
1991-92	76.66	59.76%	1500.00	15.00%	5.11%
1992-93	127.05	65.73%	1700.00	13.33%	7.47%
1993-94 (a)	145.60	14.60%	2000.00	17.65%	7.28%
1994-95	228.26	56.77%	2900.00	45.00%	7.87%
1995-96	337.02	47.65%	3063.82	5.65%	11.00%
1997-98	636.05	88.73%	4590.00	49.81%	13.86%
1999-00	890.82	40.06%	5493.25	19.68%	16.22%
2000-01	1067.87	19.87%	5388.75	- 1.90%	19.82%
2001-02	1077.02	0.86%	5417.27	0.52%	19.88%
2002-03	1199.52	11.37%	5835.70	7.72%	20.55%
2003-04	1346.61	12.26%	7416.00	27.08%	18.16%
2004-05 (b)	1566.70	16.34%	8679.40	17.04%	18.05%
2005-06 (c)	1836.18	17.20%	10315.00	18.84%	17.80%
2006-07 (d)	2063.67	12.39%	12334.04	19.57%	16.73%
2007-08 (e)	2429.58	17.73%	14050.00	13.91%	17.29%

***Source**: Computed from BEPZA (Bangladesh Export Processing Zones Authority) data; Key Indicators of Foreign Trade Statistics 2006-07, BBS; The UNSD Annual Totals Table (ATT), IMTSS, the United Nations Statistics Division (UNSD), 2000; 1990-94 country export data (all in round figures) from 'Bangladesh 2008, CIA World Factbook'.*

***Notes**: (a) Dhaka-EPZs starts exports ($5.23m); (b) Ishwardi-EPZ starts exports ($1.09m); (c) Adamjee-EPZ starts exports ($0.23m); (d) Uttara-EPZ starts exports ($0.08m); (e) Karnaphuli-EPZ starts exports ($9.86m).*

A detailed report by the World Bank (2008) suggests that over a decade and half (1990-2006), world trade volumes have increased at an average rate of 7.4% in which exports grew at 7.6%. While world trade has grown steadily since 1990, export volumes of the DCs accelerated at an annual pace of 10% -- 3.2% faster than the export gains from high-income countries (ie, 6.8%). In contrast to these figures, Table 6.0 indicates that between 1990 and 2006, Bangladesh's exports grew at a striking rate of 17.5% (1990-2000: 22%, and 2000-06: 13%) – almost twice and/or more the rate achieved by the DCs and developed economies (DEs) as well as the world as a whole. The magnificent contribution in promoting forward linkages of Bangladesh-EPZs (BEPZs) can be easily recognized by comparing growth rates of BEPZ-exports and the rates at which national exports grew during 1990-2006.

Table 6.0[4] indicates that exports from BEPZs had been rising at a remarkable rate of 35% (1990-2000: 52%, and 2000-06: 13%) – about 18% more than the growth in national exports in the aforesaid period. Kundra (2000) highlighted the share of EPZs in a country's exports as an index of their relative role amongst various other instruments of export promotion. Thus, the importance of BEPZ-exports at the same time can well be observed from the fact that these have had occupied an average yearly share of about 13.5% in total country-exports (1990-2000: 9%, and 2000-06: 18.6%). Finally, although not much important in the context of this study, it is impressive to note here that the recently established EPZs facilitated 9% (total: 19095) of the total employment created by the BEPZs – the rest accommodated by the pioneer two: Chittagong- and Dhaka-EPZs (total: 199204) by 2008.

FORWARD LINKAGE BY OWNERSHIP TYPE

[4] EPZ-export data from 1983 to 1990 are deliberately ignored due to the fact that EPZs enjoyed massive growth rates ranging from 145% to 2000%. Inclusion of these data would distort the long-term averages and thus cause difficulty in comparative analysis between export growth rates from BEPZ and Bangladesh.

The trade data may be analyzed by the type of enterprise. Depending on the ownership of the units, the degree of dependence on imports, their share of trade surpluses and their gross export earnings differ. Consequently, this has implications for assessing the value added-generating potential of units operating under different ownership structures. The importance of these ownership structures in facilitating 'technology adoption and diffusion' can be recognized through the review of related literature. Empirical literature suggests that the firm's technology adoption decision relates to its *access to international knowledge* which can be transferred via FDI or through the participation in export markets (Correa *et al.*, 2008). The said ownership structures are formally divided in the following three categories by the BEPZA (Bangladesh EPZ Authority):

BOX 2.0: CATEGORIES/TYPES OF INVESTMENT

Type of investment	Description (in terms of ownership)
A	100% foreign owned (including non-resident Bangladeshis)
B	Joint venture (foreign and Bangladesh entrepreneurs)
C	100% Bangladesh entrepreneurs (resident in Bangladesh)

Source: BEPZA website, April 2006.

Studies suggest that firms with foreign ownership (eg, type A and B above) and those participating in highly competitive export markets (eg, all types above) are likely to get involved in the adoption of new and more productive technologies - product upgradations and/or cost reductions (Baumol 1990; Aghion and Schankerman, 2004, Comin and Hobijn, 2004). Coe, Helpman and Hoffmaister (1997) and Keller (2004), for example, argued that openness to trade and FDI are critical mechanisms for knowledge diffusion across countries. Openness to FDI in type A and B categories in BEPZs can not only introduce competitive pressure on firms but also allow firms to be exposed to global best practice technology and management techniques (ideas germinated from Djankov and Hoekman, 2000; Arnold and Javorcik, 2005). Table 7.0 indicates a substantial rise of the number of enterprises in BEPZs in nearly a couple of decades. Out of this, type A investments alone took the major share with 60%. Since firms with foreign ownership (eg, type A and B) comprises of 76% share among all enterprises, the greater possibility of adoption of new and more productive technologies can be assumed in BEPZs – the way Correa *et al.* (2008) suggested on the basis of a cross sectional study they conducted in Eastern Europe and Central Asia.

TABLE 7.0: EPZ- ENTERPRISES BY TYPE OF OWNERSHIP, 1990-2009

Type of investment	Investment	
	1990-91	2008-09
Type A	20 (40%)	181 (60%)
Type B	13 (26%)	46 (16%)
Type C	17 (34%)	72 (24%)
	50 (100%)	299 (100%)

Source: Computed from yearly BEPZA data, 1983-1991 and April 2009.
Note: Growth rates for types B and C are rounded up; Total number of enterprises until 1990-91 is calculated from yearly data, 1983 to 1991.

One of the most important roles played by governments while allocating enterprises in EPZs has been granting authorizations to domestic entrepreneurs to invest in EPZs (ie, type C in BEPZs). Baissac (2004), in this connection, observes heavy investments coming from 'private domestic concerns' via some institutional arrangements. A noticeable growth of type C investments during 1991-2009 in Table 7.0 indicates a similar picture for BEPZs as well. Due to its 24% share among all types of investments in BEPZs, type C category can be expected to produce a couple of positive outcomes by:

1) Allowing EPZs to play *catalytic role* in the development of the local economy 'under a number of arrangements, including subcontracting, joint-venturing, and observation' (Baisaac, 2004:72); thus
2) 'Creating the foundation for technology and knowledge internalisation' (Baisaac, 2004:72) by interacting with buyers in advanced markets (Fernandes and Isgut, 2007; Wagner, 2007).

According to Table 8.0, during 1993-96, foreign-owned enterprises (type A) in the BEPZs were the biggest importers. The value of imports as a share of the value of exports exceeded 92%. Type A companies were followed by those under local ownership (type C) as well as joint ventures (type B). In both the cases, the figure was about 77%. Given their lower import dependence, the joint ventures and local enterprises in the EPZs are performing better as net foreign exchange earners *vis-à-vis* the wholly foreign-owned firms.

TABLE 8.0: YEARLY AVERAGE TRADE PERFORMANCE OF THE EPZ- ENTERPRISES BY TYPE OF OWNERSHIP, 1993-96 AND 2008-09

Enterprise type	Exports ($m)		Imports ($m)		Imports as % of exports		Trade balance (in m$)	
	1993-96	2008-09	1993-96	2008-09	1993-96	2008-09	1993-96	2008-09
Type A (Foreign-owned)	270.48 (87.25)	2043.83 (78.99)	249.80 (89.13)	1270.79 (78.34)	92.35	62.18	20.68 (69.54)	773.04 (80.08)
Type B (Joint ventures)	9.94 (3.21)	147.03 (5.68)	7.65 (2.73)	105.61 (6.51)	76.96	71.83	2.29 (7.70)	41.42 (4.30)
Type C (Local origin)	29.60 (9.55)	396.64 (15.33)	22.83 (8.15)	245.81 (15.15)	77.13	61.97	6.77 (22.76)	150.83 (15.63)
Total	310.02 (100.00)	2587.50 (100.00)	280.28 (100.00)	1622.21 (100.00)	90.41	62.69	29.74 (100.00)	965.29 (100.00)

Source: Computed from BEPZA data, 1993-96 and 2008-09.
Notes: 2008-09 indicate the period of 1 July 2008 to 30 June 2009;
Figures in parentheses stand for percentage shares of types A, B and C enterprises in column totals.

Figures for 2008-09 in Table 8.0 show some promising pictures for Bangladesh. By 2008-09, the overall value of imports as a share of exports fell by nearly 28% to about 63%. Although the foreign-owned enterprises (type A) are still the biggest importers in 2008-09 in absolute terms, the share of imports as percentage of exports reduced by 30% to 62% - a rate very similar to the one showed by type C enterprises (ie, nearly 62%). There is no noticeable improvement with the import share in exports for type B enterprises. The 2008-09 rate, ie, 71.83%, pinpoints the possibility that the joint venture enterprises might still prefer to procure inputs from their partner or sister organisation abroad. Column 5 shows an enormous rise in the trade balance from $29.74 million to $965.29 million in nearly 20 years time with type A enterprises securing 80% share, thus displaying overwhelming foreign dominance in the overall trade scenario of the EPZs as well as indicating the importance of FDI (as observed in Sharif, 2011).

BACKWARD LINKAGES

Jenkins, Esquivel and Larrain (1998) conclude that the EPZs are likely to be more successful when strong backward linkages can be developed: creating a demand for intermediate goods and services can enhance the viability of local industrial and service sectors and improve the host nation's labor and managerial skills.

Making an economic measurement of backward linkages generated by export-oriented firms in the local economy is however not straightforward (Leinbach, 1982). One measure uses the percentage of raw materials purchased locally by these firms as a share of total raw materials used. Another method, which may arguably give a better indication of the degree of integration of export-oriented firms in the host economy, uses the percentage of domestic expenditures in total output including wages paid, rental costs, purchases of locally procured raw materials and supplies, as well as other services (Jenkins *et al.*, 1998). Interestingly, in both the cases, locally procured raw materials and supplies have got special importance as a measure of backward linkages. We therefore measure backward linkages using this indicator.

Although the overwhelming dependence of EPZ enterprises on imports is a well-known phenomenon, DCs, when opting for establishing EPZs, generally hope that the scope and magnitude of local sourcing by enterprises in the zone will increase over time. The expectation is that the demand for goods and services by the EPZ units will be met by domestic enterprises which would supply inputs of good quality and at competitive rates. They envisage that the EPZ units would encourage potential local suppliers to enhance their capability in order to match the new demand. The Government of Bangladesh (GOB), in order to facilitate this process of matching demand and supply, is observed to extend to local suppliers fiscal incentives similar to those offered to exported-oriented units in the domestic tariff area (DTA). It is because, the supplier's outputs are deemed to be exports. Currently, enterprises in the EPZs procure their inputs through four channels, viz.

(a) foreign imports,
(b) inter-zone trade,
(c) intra- zone trade, and
(d) the DTA (domestic tariff area).

An enlargement of the purchases of goods and services from the DTA would, from the host country's point of view, represent a favourable change in strengthening backward linkage.

According to Table 9.0, during 1995-96, $3.15 million worth of inputs accounting for 1.16% of total imports by the zone was procured from the DTA, 0.92% was supplied by units located inside the zones (intra-zone) and 0.26% originated from the zones (inter-zone). In short, foreign imports constituted 97% of total imports by enterprises in the EPZs. Although the dominance of foreign imports is still visible in the EPZs, there is a sign of improvement as non-foreign sources secured nearly 20% share in total imports in 2008-09 –a rise of 17% over the 1995-96 figure. Table 9.0 also shows that imports from the DTA as a percentage of total imports alone increased to 11% in 2008-09 from only 1% in 1995-96. The aforementioned figures suggest that the EPZ-enterprises are inclined towards making use of local suppliers, ie, DTA (columns 1, 3 and 5, Table 9.0).

TABLE 9.0: ORIGIN OF IMPORTS BY ENTERPRISES IN THE EPZS, 1995-96 AND 2008-09 (IN MILL. US$)

Enterprise Type	Raw, Packing and Auxiliary Material							
	DTA		Foreign		Intra-Zone		Inter-Zone	
	1995-96	2008-09	1995-96	2008-09	1995-96	2008-09	1995-96	2008-09
Type A (Foreign-owned)	2.20 (0.81)	103.54 (6.38)	231.75 (85.65)	1047.24 (64.56)	2.42 (0.89)	91.67 (5.65)	3.63 (1.34)	28.35 (1.75)
Type B (Joint ventures)	0.33 (0.12)	17.66 (1.09)	7.43 (2.75)	81.72 (5.04)	0.00 (0.00)	4.22 (0.26)	0.00 (0.00)	2.01 (0.12)
Type C (Local origin)	0.62 (0.23)	59.93 (3.69)	22.15 (8.19)	172.81 (10.65)	0.06 (0.02)	4.70 (0.29)	0.00 (0.00)	8.36 (0.52)
Total	3.15 (1.16)	181.13 (11.17)	261.33 (96.58)	1301.78 (80.25)	2.48 (0.92)	100.58 (6.20)	3.63 (0.26)	38.72 (2.39)

Source: Computed from BEPZA data, 1995-96 and 2008-09.
Note: 2008-09 indicate the period 1 July 2008 to 30 June 2009; Figures in parentheses stand for percentage shares of BEPZ-imports.

It must be noted however that imports from the DTA may be underestimated because the data cover only those supplies which are procured with the approval of the BEPZA. There exists a host of items which are "freely" imported from the DTA (eg, office stationary). Altogether, it is thus reasonable to argue that technological competence of the local suppliers has been on a rise over the years due to the growing presence of EPZs in the local market of intermediate goods and services.

Table 10.0 makes an enquiry into the origin of imports by the local enterprises (Type C investors) in comparison to the ones computed for selected countries that include neighboring country, India, and successful East Asian counterparts. As compared to any of these countries, Bangladeshi enterprises in the EPZs have procured substantially more inputs from DTA. The imports made by the local enterprises from foreign sources (ie, 70%) appear to be much lower than the ones done by other countries - Hong Kong being the lowest (ie, 81%) & Malaysia the highest procurer (ie, 95%).

TABLE 10.0: ORIGIN OF IMPORTS BY ENTERPRISES OF LOCAL ORIGIN (TYPE C) IN THE EPZS, SELECTED COUNTRIES, 2008-09 (MILL. US$)

	DTA	Foreign	Intra-zone	Inter-zone	Total
Bangladesh	24.38	70.30	1.91	3.40	100.00
India	5.15	93.88	0.14	0.83	100.00
Hong Kong	6.28	81.25	10.19	2.28	100.00
Malaysia	2.31	94.67	3.01	0.00	100.00
Japan	2.55	93.02	4.07	0.36	100.00
S. Korea	3.77	87.56	5.94	2.73	100.00

Source: Computed from BEPZA data, 2008-09.
Note: 2008-09 indicate the period - 1 July 2008 to 30 June 2009;
Figures in parentheses stand for percentage shares of the origins of import in total imports.

Although Tables 9.0 -10.0 highlight some promising backward linking pictures for Bangladesh-EPZs, it is important to take into consideration that imports by EPZs from the domestic economy essentially consist of peripheral items such as packaging and auxiliary materials. The products imported by units in the EPZs are observed mainly to be related to textile and wearing apparel. The other inputs of any consequence, produced from domestic sources, are for the production of footwear and leather goods. The total absence of fabricated metal products in imports from the DTA comes as a surprise, given the level of development of this activity in the national economy.

According to the entrepreneurs in the CEPZ, imports from domestic sources are relatively limited as compared to foreign sources because of the *inferior quality, high cost* and *unreliable supply.* As a result, enterprises even opt for inputs of relatively higher cost but which are supplied by a more dependable foreign source. It should be borne in mind that reluctance to rely upon local raw material also stems from the global strategies of the MNCs to which EPZ-enterprises mostly belong. Due to the cumbersome administrative arrangements governing duty-free exports, many local firms fail to supply their products to the EPZ-units at competitive prices by taking advantage of the incentive package on offer. Also, the volatile political situation in the country often deters the EPZ entrepreneurs from depending on local suppliers.

CONCLUDING COMMENTS

In partial fulfilment of the objective of recognising the degree of '*catching up*' and the possibility of '*closing technology gap*' with respect to the EPZs in Bangladesh (BEPZs), the empirical examination of the industry distribution in BEPZs based on certain propositions showed that the low-end high-tech industries (heavy engineering and electronics) have been increasingly occupying higher share over the years in comparison to the share of low-techs (such as garments). In consideration of these yearly progresses in industry mix in EPZs, it can be said that the degree of 'technology gap' has narrowed down to a greater extent.

The (computed) time series information on imports, exports and the trade balance of the EPZs has given an impression that the Bangladeshi zones have been able to maintain an average yearly net export of 20% of the total. Although export volumes have been increasing at a high rate every year, the increasing rate of imports at the same time has not allowed gaining higher net exports as has been observed in East Asia, especially, Korea. Since imports in the EPZs constitute a large volume of capital goods, royalties, technical fees, etc., EPZ-literature postulate that higher import in the form 'sophisticated technologies' can provide the host country-manpower an opportunity of *learning by using* leading to *spillover effects*. But, as long as an EPZ is dominant with higher proportions of labour intensive industries, the probability of *learning by using* and *catching up* becomes very low due to abundant use of low-technologies. However, since the proportion of capital intensive industries is increasing at a very high rate in BEPZs, the degree of *learning* and *catching up* can be expected to be higher.

As it is found in Sharif (2011) that 'national technological capability' (NTC) of a developing country (DC) like Bangladesh is intrinsically weak in terms of innovational activities, the EPZs need to play a very strong role in kick-starting the technological development process in the economy. In this connection, what EPZs need to do is to continue welcoming high-tech industries and promote linkage with the local research-oriented institutions so that strong *spill-over effects* on the economy induce development of *indigenous human capital* with latest *technological know-why*. It justifies Sharif's observation (2011) on the importance of 'skilled labour' (or what vintage models postulated as 'dated labor') in operating an EPZ-scheme as a 'high road' strategy – the strategy pursued in East Asia or what Latin America practiced as a 'third generation EPZ' in their maquiladora-strategy. As a whole, this study however pinpoints that there is no alternative to developing a great amount of *dated workforce* for the DCs like Bangladesh that may pursue EPZ-strategies as technological *kick-starter* of their economies.

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