The role of technology and human capital in the EPZ life-cycle

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This article proposes an alternative perspective for examining export processing zones (EPZs) by modifying the life-cycle approach. It highlights the two crucial aspects of a successful EPZ development, namely the nature of backward linkages and gradual integration into the rest of the host economy. It argues that successful EPZs can be a catalyst for structural transformation of the wider economy and discusses what policy measures are needed to achieve such outcome. The article concludes by identifying venues for future research.

Key words: export processing zones (EPZs), developing countries, foreign investment, technology, human capital, life cycle

1. Introduction

The utility of export processing zones (EPZs) as a development tool is based on the premise that they can help achieve three interrelated goals: enhancing foreign exchange earnings by promoting non-traditional exports; creating jobs and income; and generating technology transfers and spillovers (Warr, 1989).

Over the past 30 years, the success of a number of EPZs in developing countries to achieve these objectives has prompted other developing countries to turn to EPZs as a way of making their development strategies more outward-oriented. However, developing countries have had varied results with this strategy: some EPZs have emerged as dynamic engines of growth, while others have created little benefit and turned out to be net drains on government resources. Such contrasting outcomes demonstrate the need for further examination into the factors that determine the success or otherwise of such zones. This article proposes a comprehensive model of EPZs based on the life-cycle approach. In particular, it delineates two dimensions of dynamic development of EPZs, namely rising technology intensity of local inputs and increasing integration of the zones into the host economies.

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The organization of this article is as follows. The next section reviews the literature and discusses the arguments for and against the use of EPZs. Furthermore, it classifies the experiences of various EPZs – as reported in the literature – into four categories. Section three discusses the two crucial aspects of dynamic development through the examination of EPZs in a number of developing countries with a special attention to China's Special Economic Zones (SEZs – China's variation of EPZs). We argue that investment in human capital and technology upgrading is crucial for the success of EPZs. Section four argues that as EPZs mature and the capabilities of local suppliers develop, backward linkages are created and they may ultimately contribute to structural transformation of the host economies. Section five postulates three possible scenarios for EPZ development. Section six concludes the article by proposing venues for further research.

2. Literature review

The effectiveness of EPZs in developing countries has been debated for more than two decades. Among those supporting the use of EPZs, Haywood (2000), for example, asserted:

> Indeed, the zone concept is so powerful, that more and more countries are recognizing a new paradigm of free zones. While the old free zone was often described as a static, labor-intensive, exploitative enclave, the new zone paradigm is a dynamic, investment-intensive, management-driven, enabling, and integrated economic development tool. (p. 1)

Similarly, Rhee and Belot (1990) identified EPZs as one of several possible factors helping developing countries to increase non-traditional exports. For Radelet (1999), the experience of the original four Asian Newly Industrializing Economies (NIEs)[1] provided empirical support for the argument since in their early years of industrialization, "manufactured exports did not expand rapidly in any country except through one of these facilities" (p. 12).

In contrast, other authors found EPZs ineffective for promoting economic development. Kaplinsky (1993), for instance, argued that by establishing EPZs that specialized in unskilled labour-intensive export processing, the Dominican Republic had experienced immiserizing

[1] Newly Industrializing Economies. The four countries originally identified as NIEs were Hong Kong (China), the Republic of Korea, Singapore and Taiwan Province of China.

growth. More recently, Moran (2002) observed that "EPZs and FTZs[2] have a very problematic record" (p. 17). Jayanthakumaran (2003) found that "EPZs generated only limited number of backward linkages to the host country's economy" (p.53). Tekere (2000) also contended that:

> ... there are virtually no successful examples of EPZs in Africa other than Mauritius and that as second best development strategy, EPZs have become irrelevant and outlived their viability. (p. 38)

2.1 Economic analysis of EPZs

The diverse views on the effectiveness of EPZs reflect, to an extent, differences in the analytical framework employed. Madani (1999) identified three prominent schools of thought on the overall economic impact of EPZs: the neoclassical, the new growth and the life-cycle approach.

The *neo-classical school* criticized EPZs as creating inefficiencies that distort free-market mechanisms. Madani (1999) argued, for example, that:

> ... the creation of zones will increase inefficiency by distorting production away from its comparative advantage. The FDI flowing into the EPZ means that capital is imported while labor is withdrawn from the domestic sector to work on it. This will distort production away from its factor-based competitive efficiency. (p. 85)

An opposing view had earlier been expressed by Spinanger (1984), who saw this argument as built on the presupposition of full employment, when in fact most developing countries were characterized by severe unemployment and underemployment.

A variation on the neoclassical approach was to examine the effects of EPZs on the host economies through a cost-benefit analysis such as the one developed by Warr (1989) and extended by Jayanthakumaran (2003). This methodology compared the opportunity costs of establishing an EPZ with the levels of employment and foreign exchange earnings generated by the zone. Warr (1989) found that some EPZs' earnings did not cover the costs of the investment in them and that the opportunity costs of such investments did not justify the concessions granted (tax and tariff breaks). Some zones may even have

[2] Free Trade Zones

had a negative net present value for the country. However, Johansson (1994) and other critics maintained that such cost-benefit analysis failed to take into account less-tangible or dynamic benefits, in particular those related to spillovers, such as demonstration effects.

A second school, the *new growth theory*, emphasizes the importance of knowledge creation. According to Cortright (2001):

> New Growth Theory emphasizes that economic growth results from the increasing returns associated with new knowledge. … Markets fail to produce enough knowledge because innovators cannot capture all of the gains associated with creating new knowledge. … [The theory has] many implications for economic development policy. [It] underscores the importance of investing in new knowledge creation to sustain growth. Policy makers will need to pay careful attention to all the factors that provide incentives for knowledge creation (research and development, the education system, entrepreneurship) (p. 1)

Johansson (1994), one of the proponents of the new growth theory, applied the theory to the analysis of EPZs in developing countries. She emphasized the transitory nature of EPZs, the importance of spillovers from FDI into the local economy, and the centrality of backward linkages. She found three interrelated reasons as to how and why EPZs can contribute to the industrial development of a developing country:

> First, domestic firms lack needed technical, marketing and managerial know-how, and FDI within the zones fills this gap. Second, domestic firms seldom have access to international distribution channels and need support from international or joint-venture companies. Finally, entry channels into international markets would be difficult without access to established foreign firms with wide international business dealings. (p. 390)

Extending this idea further, Baissac (2004) observed:

> New Growth and Neo-institutionalism sought to reaffirm that social and political institutions had a key role to play in the market above their influence on the allocation and cost of labor and capital. The theories proposed that economies were not simply machines that spontaneously created or destroyed wealth, but were social constructions informed by knowledge. (p. 4).

One implication of these arguments is that government has a role in promoting technological learning and development, possibly through the use of EPZs.

However, critics argued that the new growth theory relied too much on the establishment of backward linkages where none might exist or even potentially exist. Rhee and Belot (1990) maintained that the new growth theory was not supported by empirical evidence. Radelet (1999) argued that the failure to develop backward linkages was a result of the assembly-line nature of export-oriented production in a typical EPZ – firms import components for assembly and make few purchases from local suppliers. Moreover, the relatively low levels of technology used in typical EPZ operations, such as garment and shoe production, left little scope for technology transfer.

A third school proposes the life-cycle approach to analysing EPZs, which focuses on their dynamic nature and addresses how EPZs need to evolve over time as the host country's economy modernizes and liberalizes. Basile and Germidis (1984) proposed one of the first life-cycle models of EPZ development. Their model (summarized here) had four phases:

- provision of basic infrastructure and facilities, prompting an inflow of FDI;
- exports expand strongly, even while the rate of FDI inflow begins to slow;
- slower growth in exports and the replacement of small marginal businesses;
- disinvestment by foreign enterprises (pp. 60-61).

Schrank (2001) presented a life-cycle model of EPZ development that incorporated the critical roles of market size and previous national experiences with import-substitution industrialization. Haywood (2004) added:

> Zones are changing. Before 1955, many of the zones focused on being real-estate developments. They created buildings, and a zone made them more attractive to lease. Between 1955 and 1975 zone management focused on marketing their zones. Today, leading zones like Jebel Ali[3] know that the focus of the zone in the future is going to be on service to the clients of the zone (p. 1).

[3] Located in Dubai.

None of the approaches outlined above gives adequate attention to the critical ingredients of success, namely human capital and technological development. While the new growth theory and the emerging life-cycle theory allude to the significance of these intangible factors, this study proposed a more holistic approach to analysing the EPZ life-cycle, highlighting the importance of these two factors as the facilitators of backward linkages and spillovers.

In order to contextualize the issue, we will first review the experience of EPZs in various developing countries.

2.2 Four categories of EPZs

Various authors (e.g. Madani, 1999; Radelet, 1999; Schrank, 2001; Tekere, 2000) identified different types of EPZs. One way of organizing them for analytical purposes is to classify them into four categories.

The earliest EPZs tended to be enclaves that were largely isolated from the rest of the host economy. The arche type of such enclaves were those in extractive industries, many of which started when most of today's developing countries were colonies of the European powers.[4] A more recent manifestation of such enclaves is an export platform, which typically attracts foreign manufacturers seeking low-cost labour to produce labour-intensive goods, such as garments, shoes, toys and simple electrical and electronic appliances. The economies in which such EPZs were created tended to be relatively closed, highly regulated and relatively static, and hence the EPZs were largely isolated from the rest of the economy. Nonetheless, some of them were able to generate enough benefits to address political concerns over unemployment and foreign exchange reserves, and thus unwittingly helping to perpetuate the highly constrained nature of the economies. A World Bank discussion paper (1992), for example, observed:

> A successful EPZ may just as easily conserve an inward oriented industrial structure in the host country if it generates enough export earnings and creates employment, thus prolonging the time period in which a country can pursue a protectionist policy. (p. 5)

According to this view, enclave EPZs could make only limited contributions to developing countries' economic development.

[4] To a certain extent, the experience of enclave EPZs in this period shapes the attitude of developing countries toward FDI even today

The second category of EPZs are those that acted as testing grounds that guided the direction of future economic liberalization, with EPZs in China and Mauritius as prime examples. Tekere (2000) observed:

> Being special enclaves operating within a country, EPZs are expected to serve as indicators – giving guidance as to more trade liberalization or vice versa. In other words, a successful EPZ program, for example in terms of growth of exports, employment, technology transfer, and downstream effects, would signal the desirability and explosion of the trade liberalization program to cover the whole domestic economy, while non-successful EPZs may signal the reverse policy direction. (p. 37)

Radelet (2004) discerned a similar approach:

> Governments … examined markets from the perspective of the firm and attempted to eliminate obstacles that undermined firm competitiveness, such as license requirements, slow and corrupt customs administration, high tariff rates, and poor infrastructure. In most cases, they did not try to solve these problems for the whole economy at once, but rather created an enclave (e.g., through an EPZ) where at least some firms could be competitive, and then worked to see the enclave spread throughout the economy over time. (p. 6)

The third category of EPZs are those that functioned as part of a country's overall liberalization process, including freeing-up of macroeconomic, trade and exchange rate regimes. This approach is becoming more common as developing country governments increasingly adopt market-oriented development policies (Stoever, 2001). The role of EPZs in this case is transitory. Thus, Madani (1999) observed:

> As the economy opens up and a country develops its capacity for competitive industrial exports, EPZ exports and employment fall. In this light, EPZs have a specific life span, losing their significance as countries implement systematic reforms. (p. 17)

Crucial ingredients for such a transition process include the fostering of backward linkages and the initial provision of special incentives to local producers and suppliers, such as tariff reductions on imports for domestic exporters. Tekere (2000) noted:

> A few studies have reported cases where some significant linkages were created, particularly where EPZ treatment was extended to firms outside EPZs. In each case customs authorities encourage

> domestic producers to supply the EPZs by giving them access to material inputs at duty-free prices. (p. 42)

Korea's Masan zone is a typical case of such an arrangement.[5] However, this model presupposes that the introduction of EPZs occurs concurrently with nation-wide economic reform – a pre-condition that was largely absent in the case of China where the creation of the SEZs, in fact, preceded more general institutional reform.

A fourth category may be seen as a failed version of the third, applicable to a large number of countries (many of them in Africa, and some in South Asia) which have nominally liberalized their economies but have failed to attract significant amounts of FDI. Their governments have created EPZs with the usual infrastructure and incentives, often at great costs to the national treasuries. But many of these EPZs have failed to attract export-generating firms due to poor location, inadequate support services and personnel, perceived political or economic instability, or burdensome administrative requirements. The result may well have been a net economic loss to the country establishing the zone. Schaffer *et al*. (2003), for example, found that:

> Developing countries in South Asia have had marginal success with EPZs for a number of reasons. First, government policy had continued to shield vested interests, both political and economic. Domestic producers in oligopoly markets, including many of the businesses in South Asia, enjoy near monopoly power and influence over government policies that make imports uncompetitive and thereby continue to charge consumers higher prices. Other restrictions in the form of import duties and non-tariff barriers can also inhibit the development of EPZs (p. 16).

Furthermore, Tekere (2000) noted:

> ... considering the generous incentives provided which translate into huge costs for the host country and the modest benefits arising therefrom, most studies have concluded that EPZs are not a viable strategy for economic development. It would appear that the relatively successful cases are either islands or countries with coastlines. (p. 43)

It is evident that the nature of EPZs and the conditions surrounding them vary considerably. The instrumental role played by certain EPZs in

[5] See, for example, Radelet (1999)

successful economies suggests that the neoclassical approach does not fully take into account the impact such EPZs could have. At the same time, the existence of a large number of EPZs in the "failed" category raises question as to what factors determine the success or failure of EPZs. In the next section, we will turn to this question.

3. Towards an integrative life-cycle EPZ theory

This section examines the factors that determine the relative dynamism or stasis of EPZs in the context of the life-cycle approach. It identifies and charts two dimensions of dynamic development:

1. Upgrading local inputs supplied to producers in the EPZ in terms of technological sophistication and value-added; and

2. Increasing integration of EPZs into the local economy.

3.1. Local training and technology upgrading

Typical EPZs start by attracting foreign producers seeking low-cost labour to produce labour-intensive products such as garments, textiles, apparel, toys and footwear. They may progress to industries with more advanced technology, such as electrical and electronic equipment. Often, almost all materials and components are imported at this stage, and local inputs are mostly limited to labour and its supporting facilities. Investors train local workers in the skills and knowledge necessary to operate basic equipment to perform the assembly operations. The early EPZs established in many Asian and Latin American countries were at this level two or three decades ago; some African countries' zones may still be at this level today (Tekere, 2000).

The next step, involving more sophisticated local technology and creating more local value-added, is the assembly operation – with possibly some local sourcing of components – in, for example, the auto industry. The auto plants in the *maquiladoras* in northern Mexico moved into this stage during the 1980s. Another example of further progression is metals fabrication, which again represents a substantial advance in local technology and value-added. Increasing amounts of training and technology upgrading are necessary in order to move into production of these more sophisticated products.

An example of such technological upgrading occurring at EPZs is the Mactan Zone in the Philippines. Almost half of all EPZ firms in

this zone were in the garment and textile industries in the 1980s. By the end of the 1990's, however, only 29 of 105 firms exported garments and similar goods; the remaining firms were engaged in metal fabrication or the production of electronics, automotive parts or software (Moran, 2002, p. 26). The same pattern is seen in Costa Rica's free trade zones, where in 1987, all of the 178 export firms were garment manufacturers; by the end of the 1990s, 21% of all firms were engaged in production of electronics, electrical equipment or metals fabrication, and 36% of all new investments in 2000 were in these products (National Free Zone Council, 2001, charts 20, 29, 39). Foreign investors typically provide training in the skills necessary to produce these products, sometimes supplemented by host-government training programmes.

Host governments can take an active role in upgrading the capabilities of local suppliers. Host governments cannot normally impose local-content and other burdensome requirements on EPZ plants because of the intense competition to attract investment. But host governments can create attractive conditions and incentives that make it cost-effective for foreign plants in EPZs to acquire parts and components from local suppliers.

Domestic technological capabilities are, of course, an important factor in determining the extent to which foreign investors are able to turn to local suppliers for inputs. It is easier for an investor to create and expand linkages to local suppliers if those suppliers already have competent and experienced personnel as well as modern equipment in place. Lall (2000) noted that:

> Apart from primary resources, the most attractive immobile assets for export-oriented TNCs are now world-class infrastructure, skilled and productive labour, and an agglomeration of efficient suppliers, competitors, support institutions and services. (p. 4).

Similarly, Lall and Narula (2004) found:

> Capabilities in the host country context matter for the magnitude and intensity of technological upgrading. … Wider technology gaps between domestic and foreign-owned activities tend to lead to less backward linkages and to lower technological content in the inputs sourced locally. (p. 457)

Blomström and Kokko (2003) argued that positive FDI spillovers were less likely in countries/industries in which the gap between the technologies of domestic and foreign enterprises is large and the absorptive capacity of local enterprises is low.

In order to reduce the risks and costs to foreign investors, more forward-thinking developing country governments have made substantial investment in skills training and technology upgrading for their workforce. Ruane and Uğur (2006), in a comparative study, found:

> … evidence of convergence between productivity levels of TNCs and local enterprises in Singaporean manufacturing, whereas in Ireland the differences persist. This is consistent with the greater pro-activity of Singaporean policy in terms of developing local enterprises and their relationships with TNCs. (p. 106)

The Singaporean government agency for implementing such policy was the Skills Development Fund of the Economic Development Board. In Malaysia, the Penang Skills Development Center filled this crucial role, as did the Satellite Relations Program in Taiwan Province of China and the Investment Board in Costa Rica. In some cases, the skills development centres were established at the recommendation of foreign firms; Moran (2002, p. 41) gives the example of Intel Corporation in Costa Rica that sought the establishment of such technical-training programmes.

Moran (2002) postulated stages whereby domestic companies progress from Original Equipment Manufacturing (OEM) to Original Design Manufacturing (ODM) and finally to Own Brand Manufacturing (OBM). As the local firms move along this progression, they become more capable of implementing their own training and generating their own technology and thus become less dependent on foreign suppliers. Moran saw the Asian NIEs of Hong Kong (China), the Republic of Korea, Singapore and Taiwan Province of China as having progressed through these stages. He concluded, "[t]he potential for local firms to follow this path all the way to the end is likely to depend on the level of technology and sophistication and the pace of change in each individual industry" (p. 134).

At the macro level, Moran (2002) identified a number of economic and legal policies that make it possible for local suppliers to flourish:

- creating a stable macroeconomic environment with low inflation rates for locally-owned businesses to operate in;

- reducing or eliminating impediments to operations of local firms through lowering import tariffs and allowing them access to adequate infrastructure; and

- enlarging the supply of both capital and skilled labour (workers, technicians, engineers, and managers) available to local firms. (p. 129)

China provides a particularly noteworthy example of such progression. It began establishing SEZs in coastal areas in the late 1970s. The first was the Shenzhen SEZ, established in 1978 in a seacoast town in the province of Guangdong, where 20,000 inhabitants had previously been largely engaged in agriculture and fishing. Over the next two decades, the province's industry went through a remarkable transition from agriculture to labour-intensive and then more technologically intensive manufacturing. The experience of the Shenzhen SEZ can be seen as having gone through three stages of development.

In the first stage between 1980 and 1982, the authorities implemented programmes for the development of energy, transportation and telecommunication systems. In addition, government reforms within the SEZ administration cut down bureaucracy and new regulations were introduced to protect the interests of foreign investors (Xie, 2000, p. 5).

The second stage, roughly 1982 to 1990 (the "processing and assembly and compensation trade" stage), focused on the development of light labour-intensive industries. During this stage, SEZ administrators maintained a constant flow of unskilled and semi-skilled workers into the zone, and foreign firms in the zone gave them sufficient training to operate the equipment efficiently. Xie (2000) noted:

> ... the ability of FDI to perform successfully in large domestic Chinese and export markets, however, was dependent upon how effectively foreign investors could transfer their technological capability. Technological learning in processing and assembly enterprises was significant…and [they] accumulated manufacturing experience to the extent of being able to design their own products. (p. 7)

The SEZ administrators and government officials, recognizing the essential role of technology in the development of EPZs, developed policies such as the "science and technology development plan" and the "strategy of science and technology development" to help draw engineers and technicians from other parts of the country to the SEZ. Moreover, instead of just offering fiscal incentives to foreign investors, the SEZ administration introduced policies to protect intellectual property rights in order to reduce the risk associated with technology-intensive foreign investment. Thus, the Shenzhen incentive package was designed specifically to attract high-technology investment.

The third stage, the technology-intensive stage, began in the early 1990s. Xie (2000) noted:

> ... the Shenzhen SEZ is becoming a center for high-technology industries. In 1998, high-tech industries accounted for nearly 40% of industrial output within Shenzhen. High-tech industries rather than labour-intensive industries now support Shenzhen's dynamic economy. (p. 2)

Xie considered this dynamism to be the result partly of deliberate government policies to upgrade the region's supply of human capital and technological capability and partly of natural tendencies that occur in the EPZ cycle. Thus, "[In Shenzhen] because of the rising costs of production factories (land, labour, etc.), and competition from other low-cost regions, manufacturing must gradually shift into technology-intensive industries" (p. 10).

The success stories of EPZs in China, the Republic of Korea, Malaysia, Singapore, and Taiwan Province of China are similar in that local government and private investments in human capital facilitated spillovers and backward linkages that helped transform fledgling local firms from suppliers of simple parts into OEMs and finally OBMs. Moran (2002) noted "This process combined teaching and coaching on the part of the foreign purchasers with imitation, catch-up, and incremental innovation on the part of indigenous producers" (p. 134). The development of local suppliers began, in each case, with liberal EPZ regimes that did *not* impose requirements for minimum domestic content or joint ventures with local firms. Instead, EPZ administrators provided individually-tailored directories identifying prospective domestic suppliers, but they left it up to the foreign firms to decide whether and how much local sourcing to do. They, thus, created an environment in which backward linkages could enhance foreign investors' competitiveness rather than diminish it. The host governments' roles gradually evolved into providing "screening mechanism[s]" whereby foreign firms could "identify potential suppliers who can then with state assistance follow investor recommendations for technology upgrades" (Moran, 2002, p. 132).

3.2 Integration of EPZs into the domestic economy

The degree of integration of EPZs into the domestic economy is largely determined by the decisions taken by the host country government; they are policy-oriented and administrative in nature. One

of the major decisions is whether, and at what pace, local firms should be allowed to move into the zones in order to benefit from the same advantages that foreign investors enjoy. A related decision is whether and when to allow the sale of EPZ-produced goods in the domestic economy. Although these decisions will ideally be based on rational assessments of the country's readiness to integrate EPZs into the domestic economy, in practice, they are often based on political considerations as much as economic ones.

EPZs that progress into the more advanced stages create various benefits for the wider economy. Moran (2002, citing McKendrick *et al.*, 2000) noted the following externalities:

> ... the movement of workers and managers among firms; the nearly instantaneous matching of machinery purchases and imitation of successful production and quality-control procedures by proximate rival companies; the accumulated knowledge that suppliers with multiple clients could apply to new orders; and the coaching that foreign investors provided to assist local producers in expanding their exports. (p. 132)

Each of these externalities contributes to the breaking down of the barriers between the zone and the rest of the host economy. Each is also accelerated as the host country increases the training and technological capabilities of its workers. The experience of China provides an illustrative example. Following the early success of Shenzhen, the government established four more coastal SEZs in 1979 and, later, the Hainan Island SEZ in 1984 and Pu Dong SEZ of Shanghai in 1991. Over the next few years, it designated fourteen coastal cities as open cities for foreign investment. The proliferation of SEZs and open cities gradually blurred the lines between the zones/open cities and the rest of the country.

Moran (2002) noted the special case of small but progressive island economies, commenting that "Authorities in both Singapore and Hong Kong essentially turned each country in its entirety into a single integrated EPZ" (p. 125). The same was true to some degree in Mauritius, although its EPZ industries have not progressed beyond the stage of carrying out the assembly work on imported components (Tekere, 2000).

In less successful examples, such as Egypt, Ghana, India and Tunisia, the governments failed to provide the institutional support to foster backward linkages and more liberal environments and thus inhibited their EPZs from moving further along the EPZ trajectory

(Madani, 1999; Radelet, 1999; Tekere, 2000). They did not encourage domestic producers to move into the zones either and, in some cases, actively prohibited them from doing so. As a result, extensive backward linkages failed to develop, and these EPZs remained stagnated as isolated enclaves.

Technology upgrading and integration into the host economy as discussed in this section tend to take place in parallel, as seen in the experiences of the Asian NIEs and China. This concomitance is not inevitable, however; EPZs in India, Pakistan and other countries remained quite isolated from their respective host countries despite the increasing sophistication of the products they produced and exported (Schaffer *et al.*, 2003, p. 16).

In cases where EPZs successfully evolved with regard to these two aspects, there is evidence that they played a catalytic role in transforming the wider host economy. The next section will review the experience of such successful economies.

4. EPZs as catalysts for structural transformation

Successful development of EPZs may actually help promote structural transformation of the host economy. Indications that such a transformation is taking place may be found in various statistical measures of the host economy. Thus, table 1 shows the shift in production in EPZs of Taiwan Province of China from labour-intensive to technology-intensive products over three time periods. Not surprisingly, the proportion of plants producing labour-intensive products declined from 74% in the period 1965–1973 to 50.4% in the period 1984–1994, while

Table 1. Shift from labour-intensive to technology-intensive production in EPZs of Taiwan Province of China

% of Industrial Infrastructure	**Labour Intensive Industry**			**Technology Intensive Industry**		
	Plant %	**Worker %**	**Turnover %**	**Plant %**	**Worker %**	**Turnover %**
First Phase (1965-73)	74 %	52%	40%	26%	48%	60%
Second Phase (1974-83)	60%	39%	30%	40%	61%	70%
Third Phase (1984-94)	50.4%	25.5%	12.6%	49.6%	74.5%	87.4%

Source: Taiwan Province of China, Ministry of Economic Affairs (1996).

the proportion of workers producing technology-intensive products increased from 48% in the period 1965–1973 to 74.5% in the period 1984–1994. Evidence suggests that this is a reflection of the similar restructuring of the host economy as a whole.

Table 2 illustrates a different aspect of economic restructuring, showing the drop in EPZ employment in three economies in which zones had once been significant sources of jobs. It dropped 42% in Taiwan Province of China, the one of the three economies which had made the greatest strides in industrialization. The drop in Costa Rica (over a different, shorter time period) was 40%, while in Mauritius, it was only 8.5%, consistent with the fact that Mauritius remained the most dependent on low-cost, cheap-labour exports. In a variation on this theme, table 3 shows EPZ employment as a percentage of eight different countries' total industrial employment around 1990, arranged in order of increasing percentage EPZ employment. As a generalization, economies with the lowest percentages have made the greatest strides toward economic restructuring. For example, EPZs accounted for only 0.4% of the Republic of Korea's industrial employment, while they accounted for 86% of Guatemala's industrial employment, consistent

Table 2. Decline in EPZ employment in selected economies

Country	1987	1996	2000-2003
Taiwan Province of China	95,000	55, 169	
Costa Rica	---	57, 000 (1996-2000)	34, 000
Mauritius	87, 905	80, 466	

Sources: Moran (2002), Taiwan Province of China, Ministry of Economic Affairs (1996), "Economic Overview of the EPZ Sector in Mauritius," www.itcilo.it/english/actrav

Table 3. EPZ employment and industrial employment, c. 1990

Country	EPZ Employment	Industrial Employment	% EPZ Employment
Republic of Korea	20,000	4,198,000	0.4%
Thailand	12,000	2,191,800	0.5%
Taiwan Province of China	70,700	3,420,000	2%
Costa Rica	6,000	137,420	4%
Senegal	1,200	20,188	6%
Jamaica	15,000	136,100	11%
Dominican Republic	115,000	157,576	72%
Guatemala	89,000	103,300	86%

Source: World Bank, ILO, Schrank (2001) .

with the fact that the Republic of Korea has advanced much further along the technology and industrialization trajectory. These findings are consistent with Madani's (1999) observation that:

> As the economy opens up and a country develops its capacity for competitive industrial exports, EPZ exports and employment fall. In this light, EPZs have a specific life span, losing their significance as countries implement systematic reforms. (p. 17)

Table 4 shows the cycle of export growth rates as countries' GNP per capita increases.

The export growth rate of lower middle-income countries with EPZs was 72%, while that of similar countries without EPZs was only 1%. The growth in exports of upper-middle-income countries with EPZs was 66%, while that of similar countries without EPZs was 33%. By contrast, the export growth rate of high-income countries with EPZs was 28%, while that of similar countries without EPZs was 45%. These figures are consistent with the view that EPZs have been particularly important in increasing exports in developing countries in the earlier stages of their development and that they decline in importance as those countries develop and their economies become more integrated. Further support for this argument is found in Xie's (2000) observation that:

Table 4. Export growth from countries with and without EPZs

Number of Countries/ GNP level (GNP per capita)	*With/Without EPZs*	*Growth Rate of Total Exports to EU and US 1993-1996*
High GNP (Over US $ 9385)		
28	With	28%
22	Without	45%
Upper Middle GNP (US $ 3035-9384)		
15	With	62%
28	Without	33%
Lower Middle GNP (US $ 765-3034)		
37	With	72%
30	Without	1%
Low GNP (Below US $ 765)		
	With	59%

Source: Haywood (2000).

> ... from 1974 to 1979, exports from Masan SEZ represented 4% of South Korea's total exports. However, at present, the contribution of these zones in terms of exports and industrial output appears far less impressive because the country has caught up with the firms within the SEZ's. (p. 2)

Certain structural transformations may also take place within a country's EPZs as its economy develops and diversifies. Xie (2000) noted:

> Rapid growth, technological learning, and the absorption of new technology combined can alter relative factor endowments in an SEZ, which in turn changes the prices of the factors of production as well as those of basic and intermediate inputs. (p. 2)

In Taiwan Province of China, for example, several factors led to the declining importance of EPZs:

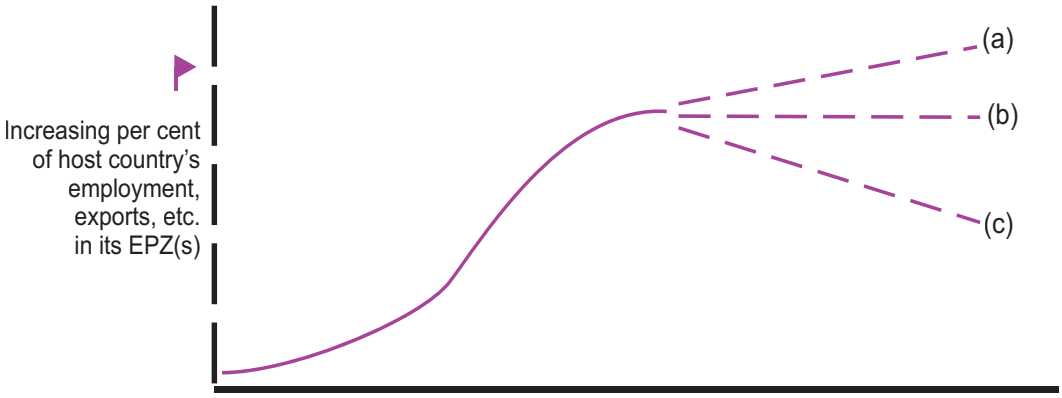
> A decrease in customs duties, shortage of labor, appreciation of [the] Taiwan dollar, incentives shrinkage compared to outside zones, and the formation of regional economic organizations made the comparative advantage of the zone disappear (Ministry of Economic Affairs, 1996, p. 81).

These observations indicate that as EPZs draw in higher-skill, technologically-based investments and become more integrated with the local business environment, the need for them to have special characteristics and privileges begins to wane. Successful EPZs help create the conditions that gradually render themselves irrelevant. They essentially work themselves out of job.

5. Postulating three scenarios for EPZ progressions

The preceding examination of EPZs expands the life-cycle theory of industrial policy and zone development so as to include the critical role of technology upgrading and human capital development. While most EPZs are capable of generating foreign exchange earnings and employment, relatively few have been able to graduate into more mature stages of the EPZ life-cycle without significant investment in local suppliers. Schrank (2001) concluded "All in all, the life cycle is premised upon the maturation of host-country infant industries" (p. 225). Skills development funds, vendor development, satellite relations and a focus on education have all been vehicles of local investment in human capital that have led to technology upgrading and thus have helped promote the EPZ objective of creating backward linkages.

Figure 1. Three Scenarios for EPZ progressions



Three scenarios for EPZ progressions can be postulated as depicted in figure 1. In all three, it is assumed that the EPZ has initially been successful in attracting some foreign investors and generating some jobs and exports. Thus, in its early stages, it accounts for an increasing percentage of the country's employment, exports, foreign exchange earnings, training of workers in new skills and in some other relevant indicators.[6] However, after the initial success, the possible trajectories may diverge.

Scenario (a): The EPZ's exports, employment, and other activities continue to increase, but the sophistication and technology of the products produced and exported does not increase. The Dominican Republic's EPZs are an example of this scenario (Jenkins *et* al., 1998; Schrank, 2001, pp. 227–228).

Scenario (b): The EPZ may have had some initial success but has failed to continue growing or attracting new plants. It has made limited progress along the life cycle trajectory but is not upgrading the sophistication of the processes it employs or the products it produces. It has attracted a modest number of foreign investors, is exporting a certain amount, and is earning some foreign exchange, but its producers have not developed extensive networks of local suppliers and have not significantly integrated into the host economy. Tunisia (Madani, 1999, p. 17) and Guatemala (Jenkins *et al*., 1998) would be examples of this scenario.

[6] Note that the absolute amounts of these benefits may be small relative to the country's entire productive capacity (especially in the case of a large country such as India) even though their percentages are increasing.

Scenario (c): This is the most intriguing progression, because it could indicate either (i) the EPZ has been unsuccessful; it has failed to attract and keep enough foreign investors, and employment, exports, foreign exchange earnings and value added in the zone have declined over time; or (ii) the zone has been highly successful, so that the share of employment in, and of exports from, the EPZ has decreased because the zone is becoming integrated into the general economy and/or jobs and exports in the wider economy have increased at a faster rate than in the zone. Examples of the former scenario include EPZs in Kenya, Egypt and Ghana and the Philippines' early experiment with the Bataan zone. The latter scenario is, of course, the most desirable, because it would indicate that the EPZ has progressed farthest along the life cycle while the economy as a whole has been successful enough to allow the government to dismantle most of the barriers between the zone and the wider economy.

These scenarios are consistent with the argument that EPZs do not in and of themselves lead to the structural transformations that developing countries seek, but they can be a significant factor in a developing country development strategy when managed right. This article has argued that investments in human resources development and technology upgrading are necessary to support the emergence of local suppliers and thus stimulate EPZs to move further along the life cycle trajectories.

However, EPZs should be seen as interim steps in the process of more general economic liberalization. Most such zones are small economic units compared to the overall host economy. The government cannot expect a few small EPZs to be the drivers for wholesale economic restructuring. In cases where the creation and expansion of EPZs did appear to be forerunners of the more general economic restructuring, the zones were, in effect, allowed to grow in size and importance, or at least, the regulatory regimes governing the zones were expanded to include more and more enterprises and geographic areas in the host economy. In China, for example, SEZs were relatively large geographic areas/economic units, and the government subsequently created numerous similar zones. In Hong Kong (China), Singapore and Mauritius, EPZs were allowed to expand to the point where they essentially incorporated the whole economy,[7] while in Costa Rica, the Republic of Korea, the Philippine, Taiwan Province of China and other countries, the barriers

[7] All of these examples involved countries with significant coastlines and easy access to international shipping. Further research may reveal ways in which EPZs may be structured so as to provide similar benefits to landlocked countries.

between the zones and the host economies became increasingly permeable over time. In every successful case, the government and other local agencies took positive steps to ensure that the necessary human capital and technical capabilities would be available to support the expansion and upgrading of production in the zones and thereby into the wider economies.

6. Further research

The primary objective of this study was to identify the factors that have helped to make certain EPZs successful. We have argued that technological upgrading and integration into the host economy are the key in this regard. Thus, "success" has to mean more than just that investment has flown into the zone and that jobs created, products exported and local value-added have increased. It must also reflect a deepening of the zones' linkages with the host economy and of the technological sophistication of the inputs purchased by companies in the zones from local suppliers.

Our analysis is largely based on existing studies in the literature. However, more research, especially data-gathering effort, is clearly needed. The question then arises as to what kind of data are needed to further our understanding of EPZs. Quantitative data can reveal indicators such as the value of investment in EPZs, the industries in which the investments are made, the number and types of employment created, and the value of exports from the zones. However, this type of data would not reveal much about the linkages between foreign investors' plants in the EPZs and local suppliers, let alone about the advancement of technology and human capital in the host economy.

More meaningful to the type of analysis carried out in this article would be data on the nature and quality of parts and components provided by local suppliers to the foreign affiliates in the zones. If the amount and value of such locally sourced inputs increased over time, this would be some indication that the linkages between the zones and the host economy were strengthening. If the variety and technical sophistication of the local inputs rose, this would suggest that the zones had contributed to the development of the country's technological capabilities. It would also be an indication that the barriers between the zones and the host country could be lowered so that the zones could be more integrated into the host economy.

Unfortunately, however, such extensive data on the nature of local inputs are not widely published, if they have even been compiled. For example, the Government of Kenya has published a table entitled "Key EPZ performance indicators: 2002-2006", which includes statistics on local purchases, local salaries and other domestic expenditures by companies in its EPZs.[8] However, it does not contain any information about the nature or composition of those local purchases, and certainly nothing about the level of technological sophistication or the quality of human-resource inputs into the components that were obtained locally. Furthermore, even if the data described above could be assembled, they would not reveal much about the *causes* of success of some EPZs and the failure of others.

Identifying the policy decisions, implementation procedures and other factors that have contributed to the success or failure of EPZs must ultimately rest on qualitative information, likely to be in the form of written reports and interviews. This approach could be expanded into in-depth case studies of particular countries' experiences with EPZs.

The authors have been fortunate, however, to gather some first-hand information on Viet Nam's experience with EPZs.[9] The country created 64 EPZs – at least one for each province – during the early 1990s as part of its programme of doi moi ("renovation," or liberalization of the economy). No statistics were available to show the nature or quantity of locally sourced inputs, but one interviewee observed that the large majority of foreign companies imported most sophisticated components for their products, and even the domestically owned companies often sought foreign parts and components. Moreover, most of the zones remained fenced off, and access to them was restricted, making them even more isolated from the rest of the economy. The rationale for this was to protect the investors, but the result was to lessen the interactions between the investors and prospective local suppliers. The government failed to implement programmes for training adequate numbers of local workers or for upgrading the capability of local suppliers.[10] Hence the

[8] Government of Kenya, Ministry of Trade and Industry, Export Processing zones Authority, official website (www.epzkenya.com/epzsinkenya/php)

[9] Information was gathered at a conference organized by Seton Hall University and UNITAR in Hiroshima, Japan, in 2006. The authors also had an interview with Mr. Nguyen Manh Hung, the Foreign Investment Agency of the Ministry of Planning and Investment, Hanoi, Vietnam.

[10] United States Department of State, Investment Climate Statement – Vietnam http://www.state.gov/e/eb/ifd/2005/42198.htm

amount of human resource development and technology transfer to local suppliers was limited.

This brief summary is only a suggestion of the kind of information that need to be gathered from interviews and similar first-hand collection of information on developing countries' policies and experiences regarding EPZs.

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