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**An Evaluation of Domestic and Trade Policies in Building
Environmental Services Capacity in Asia: Balancing Diverse
Interests and Priorities**

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1. Introduction

The environmental sector is the oldest economic sector of every country, although its nomenclature and recognition as an independent industry is new. All economic activities either derive inputs from the resource base of the natural environment or generate wastes that impact the quality of the ecosystem. According to the OECD/Eurostat definition, the environment industry comprises goods and services which measure, prevent, limit, and correct environmental damage to air, water, and soil, including problems relating to waste, noise, and ecosystems. In particular, the environmental services sub-sector is measured by revenue generated by service activities, which reduce environmental risk, minimize pollution, and enable efficient resource use. In the GATS, environmental services are classified under: (A) sewage services; (A) refuse disposal services; (C) sanitation and similar services; and (D) other environmental services. The last category, namely *other* services include pollution abatement and environmental remediation services (like cleaning services of exhaust gases, noise abatement services, nature and landscape protection services, and other environmental protection services).

In 2005, the global environment industry was estimated to be about \$600 billion, with the environmental services segment accounting for more than half of the total market.¹ Water and wastewater management is by far the most significant environmental service segment, followed by solid waste management. These form part of the infrastructural services of an economy, and capacity-building in these sub-sectors is a critical challenge for developing countries in order to provide basic services to its population.

The global environmental services industry is dominated by the US, Western Europe and Japan, where large multinational service providers have the bulk of the market share. With maturity of the environment industry in these countries, the national market growth rates slowed down, and the businesses began looking towards countries where growth potential was high. In the 1990s, Latin America and Asia emerged as the most promising regions, where there is market excess demand for environmental infrastructure services, and resource remedial services are essential to alleviate the degraded state of the environment (like cleaning of contaminated rivers). In particular, the environmental services in developing Asia has been experiencing double-digit growth through the 1990s, due to increasing stringency of domestic environmental regulations, enforcement of international environmental standards, and privatization of public sector infrastructure services.

This paper provides an overview of the state of the environmental services sector in Asia, by focusing on the most significant segments of infrastructural services namely, water, sanitation and municipal waste management. Although the WTO GATS definition of environmental services does not include all infrastructural essential services (in particular

¹ The true size of the environmental services industry is difficult to track since these services are tied to related equipment, investment flows, as well as to other services (for example, engineering, analytical and consulting services for building a waste treatment facility).

GATS excludes *collection, purification & distribution services of water, and construction repair and alteration of sewers*, while the OECD/Eurostat definition includes “water for human use” and all sewerage services), these services have taken centre stage in both the recent reform and liberalization policies in Asia as also in the GATS negotiations. Thus water treatment and distribution services are included in this paper. The analysis looks at the trade and environmental initiatives adopted in selected Asian countries in the development of their environmental services capacity. Section 2 gives a position of the Asian environmental market in the global environment industry and the significance of the different service segments. Nine countries are selected in discussing the Asian profile of current domestic environmental services provision in essential services like water and sanitation, and factors driving growth of these services. Section 3 gives an illustration of various environmental policy measures in selected countries that affected the domestic supply and export capacity in environmental services. Section 4 outlines the trade and investment regime in environmental services, and in particular foreign investment in water and sewage services.

In promoting the development of environmental services industry in developing Asia through import liberalization, a relevant issue is whether such policy instruments are consistent with the objectives of environmental protection, building a competitive domestic capacity, and encouraging small and medium enterprises. Section 5 addresses this issue through an analysis of cases of private contracts in drinking water, waste-water and sanitation services in Asia.

The current supply capacity in the environmental sector of the different countries is discussed briefly in Section 6, including the significant role of small and medium enterprises (SMEs) for increasing the coverage in essential services like water. This section also provides a summary table which classifies the different countries by their trade regime and links them to the nature of domestic supportive policies and indigenous environmental industry. Section 7 concludes with the future prospects for the creation of environmental services capacities in the region particularly in the context of the ongoing WTO negotiations.

2. Asia in the Global Environment Market

In 2005, the global environment industry was estimated to be \$607 billion², with the US, Western Europe and Japan together accounting for 84% of this market. The US, Germany,

² The data for 2000-2002 is sourced from Environmental Business International Inc. (EBI), San Diego, CA. The other data for 1003 through 2010 is estimated by ADB based on the trend. The EBI divides the environment industry data by 3 broad segments: services, equipment and resources. The services revenue is the sum of fees paid for waste water treatment, solid waste treatment, remediation, analytical and consulting services. Equipment revenues are sales of hardware, and resources are sales of materials, water utilities or energy. The EBI uses the U.S. Standard Industry Classifications system for engineering services/ environmental laboratory services (which may relate to any number of environmental problems), or specific equipment manufacturers or resource providers. (<http://www.ebiusa.com/Segments.html>)

France, Japan and the UK have the most mature environmental markets with some of the largest environmental firms in the world, which have been exporting equipment, technology and services worldwide.

The Asian environment market (excluding Japan) in 2005 was worth US\$37.5 billion, barely 6% of the global market, but its share is expected to increase to 9% by 2010 (see Table 1). The Asian developing countries have been experiencing double-digit growth through the 1990s, and the trend is expected to continue as the domestic environmental sector grows in these countries. Although small at present, the environmental markets of emerging economies in Latin America, Asia and East Europe are potentially high growth markets, since a large part of their population still lack basic environmental services like clean water, sanitation and waste management. These environmental infrastructure services had typically been in the realm of the public sector, but privatization and deregulation of utilities in these countries through the 1990s have increased the opportunities for multinational environmental firms.

Given the growth prospects of the Asian environmental markets, twelve countries in the region have been the focus of the US environmental industry since the 1990s: Eleven countries including, Hong Kong, India, Indonesia, Korea, Malaysia, Philippines, Singapore, Sri Lanka, Chinese Taipei, Thailand, and Vietnam under the United States-Asia Environmental Partnership (USAEP); and China, as a separate high growth market (outside the USAEP programme). The domestic environmental industries in these countries are still dependent on imports of equipment and technology from the more advanced markets, although countries like Korea, Chinese Taipei and China have also become competitive suppliers of the US for certain environmental goods in the Asia-Pacific region.

In terms of sectors of the global environmental market, the environmental services sector (including resource management and energy) is much larger than the goods sector. In 2001, environmental services accounted for an overwhelming 78% of the total market by value (based on data in ADB 2005, Tale 6), the two largest segments being water and wastewater treatment services and solid waste management services (non-hazardous wastes), which constituted 30% and 22% of the total environmental market.

Table 1. Global Environmental Market (\$billions), 2000-2010

<i>Region</i>	<i>Actual*</i>						<i>Forecasts</i>
	2000	2001	2002	2003	2004	2005	2010
USA	210.5	215.2	221.4	227.5	233.7	240.2	275.1
Western Europe	157.8	160.8	165.0	169.1	173.4	177.7	201.0
Japan	93.7	93.3	92.4	92.6	92.9	93.1	94.4
Rest of Asia	24.0	25.6	28.2	31.0	34.1	37.5	66.1
Australia/NZ	8.4	8.6	8.8	9.1	9.5	9.8	11.7
Other Regions	47.6	48.5	45.4	46.6	47.8	49.1	67.6
Total	542.0	552.0	561.1	575.9	591.3	607.4	705.3

* Data for 2000-02 are reported by industry, and the rest estimated based on trend.

Source: Table 6, ADB (2005): page 98.

The global exports of environmental goods, as classified by the OECD list, for 2002 was estimated to be \$238 billion (Bora and Teh 2004).³ The pattern of global trade in environmental equipment reflects the significance of the industry's segments, with the value shares of the sub-sectors being as follows: waste water management 34%; environmental monitoring and analysis 16%; solid waste management 13%; air pollution control 10% and noise abatement 12%. During 1990 through 2002, growth in trade of environmental goods at 14% p.a. was more than double the growth in merchandise goods at 6% p.a. (*ibid*).

While the US continues to be the global environmental market leader, Japan dominates in the exports to the Asian markets. During 1995-99, Japan accounted for 39% of the total environmental imports of the eleven USAEP countries, followed by the US with a share of 27%, Germany 8%, and Chinese Taipei 5% (USAEP 2001: 13).

2.1 The Major Environmental Services in Asia

Mirroring the pattern of the global environmental market, in Asia water and wastewater management is also by far the most significant environmental service segment, followed by solid waste management. These form part of the infrastructural services of an economy, and capacity-building in these sub-sectors is a critical challenge for developing countries in order to provide these basic services to their population.

Table 2. The Asian Environment Industry by Segment, 2000*

Segment	US \$ Billion	Percentage Share
Equipment		
Water equipment and chemicals	3.2	13.3
Air pollution control	3.0	12.5
Waste Management equipment	1.1	4.6
Instruments and information systems	0.6	2.5
Process and prevention technology	0.3	1.3
<i>Equipment subtotal</i>	8.2	34.2
Services		
Water utilities	5.2	21.7
Water treatment works	3.6	15.0
Solid waste management	3.7	15.4
Consulting and engineering	0.9	3.8
Clean energy system and power	0.8	3.3
Hazardous waste management	0.6	2.5
Remediation, industrial services	0.4	1.7
Analytical services	0.3	1.3

³ It is important to note that this estimate of the value of global exports of environmental goods here is not comparable to the revenue data of the industry quoted in the previous paragraph. The coverage of products and reporting sources are different. The revenue of the global environmental industry from EBI is based on the US SIC classification, and includes data reported by companies and agencies. The trade data, on the other hand, is the value of actual trade in environmental goods based on OECD/ Eurostat classification. The value of environmental trade by the OECD classification is relatively larger than that used by the EBI.

Resource recovery	0.2	0.8
<i>Services subtotal</i>	<i>15.7</i>	<i>65.5</i>
Total	24	100

* Asia here excludes Japan, Australia and New Zealand. Here, in line with the GATS negotiation classification, the *resources* segment of the EBI (including water utilities, resource recovery and clean energy system) has been considered to be under services.

Source: Adapted from Table 7, ADB (2005): page 99.

In 2000, water utilities and wastewater treatment services together accounted for about 37% of the total environmental industry by value in Asia (see Table 2). Indeed, water equipment and chemicals, was the single largest segment in the environmental goods sector) accounting for 13.3% by value of the industry. Thus water and waste water treatment segment, goods and services, accounted for close to half the entire environmental industry. Not surprisingly, water and wastewater services have been the focus of multilateral lending agencies, governments and international businesses alike, and will also be the focus in the following sections.

The next largest segment is the solid waste management services, and constituted 15% of the total environmental industry in 2000. In the goods market, waste management equipment is not as significant, rather services including waste collection, construction of sanitary landfills, or other treatment facilities and safe disposal constitute the bulk of the segment. Most municipalities in developing countries do not have the capacity to effectively dispose of the wastes been collected, and most of the waste continues to be openly dumped.

2.2 A Closer Look at Selected Asian Countries

The emerging countries in Asia differ widely in terms of their levels of economic development, economic structure, regulatory framework, and population structure. In analyzing the state of environmental services and the associated trade, investment and environmental policies, this paper will look at nine countries in emerging Asia. While each country is unique, in terms of the level of development, they fall broadly under four income groups: (i) *low income*: India and Vietnam; (ii) *lower middle income*: China, Indonesia, Philippines and Thailand; (iii) *upper middle income*: Malaysia; (iv) *high income*: Republic of Korea and Chinese Taipei.

The Republic of Korea and Chinese Taipei are the most industrialized economies within this group of countries, which adopted an export-led development path in the 1960s and achieved high growth rates in gross domestic product and per capita income in the following decades. Indonesia, Malaysia, Philippines and Thailand similarly followed open economy growth path in the 1980s, encouraging foreign direct investment and exports. These six countries have been more integrated with the global economy through the last two decades, due to focus on foreign trade and investment.

China and India began reforms later in the 1980s after decades of closed economy policies. The approach of the two countries, however, has been markedly different, with China following rather aggressive reform policies of privatization and liberalization while India following a more gradual reform process. China has successfully bolstered its economy rapidly in the last decade with an average annual growth rate of close to 10%, while India's growth has been more modest at 6% per annum. Vietnam is a transitional economy and began reforms in the 1990s.

All of these countries, except Vietnam, are members of the WTO. China and Chinese Taipei joined the WTO more recently in December 2001 and January 2002 respectively, while Vietnam is progressing towards accession into the WTO. The other six countries were signatories of the GATT and have been committed to the multilateral trading system for several decades.

Three of these countries - China, India and Indonesia - are among the four most populous countries in the world today. Together the three account for more than 40% of the current total world population. By 2015, the nine countries are expected to have a population of 3.23 billion, with China and India accounting for more than 80% of the share within this group (see Table A1 at the end).

The majority of population in China, India, Indonesia, Thailand and Vietnam remains rural. However, urban population is growing rapidly in all the Asian countries, with average annual growth rates of 3.6% in China, 2.5% in India, 4.2% in Indonesia, 3.7% in Malaysia, 3.9% in Philippines, 1.5% in Thailand, and 3.3% in Vietnam during the period 1990-2003.⁴ The Republic of Korea has the most urban society (84% of the population), with the urban population continuing to grow at 1.8% per annum. The rapidly increasing urban population in Asia is expected to put further pressure on the already inadequate infrastructural facilities

In terms of natural environmental resource endowment, Korea and Chinese Taipei are not as rich as some of the other countries in the group. In particular, China, India, Indonesia, Malaysia and Philippines are among the seventeen mega diversity countries of the world, which play a significant role in the conservation of biological diversity, mitigation of global warming and provision of other ecosystem services.⁵ Forest resources are important for preserving a wealth of plants, animals and micro-organisms. In 2005, China, Indonesia and India were among the top 10 countries around the world with the largest forest cover. Over the last five years, Asia's forest area has shown a net increase during 2000-05, an improvement over the net loss of forests during the 1990s (FAO 2005). This reversal was

⁴ Table 3.10, World Bank (2005).

⁵ Indeed 15 of the 17 mega diversity countries are developing nations, namely: Brazil, China, Colombia, Ecuador, India, Indonesia, Madagascar, Malaysia, Mexico, Papua New Guinea, Peru, Philippines, South Africa, Venezuela, and Zaire (Democratic Republic of Congo). Australia and United States are the only two developed nations. The 17 countries are home to about 70% of the world's wealth of biological diverse species.

primarily driven by China's large-scale afforestation efforts. Unfortunately, however primary forests continue to decrease. The reduction in primary forest⁶ has resulted from deforestation as well as modification of forests (selective logging and other human interventions).

Emerging Asia has depleted large part of their primary forests. Today only 0.7% of Vietnam's total forests are primary, while Korea and India have no primary forest cover left (see table A5 at the end of the paper). Forest regeneration to preserve terrestrial biodiversity in these countries, would provide ecological service benefits to at the local, regional and global level. For instance, resource recovery services in forests would enhance a whole range of ecological services including terrestrial biological diversity and local/ regional watershed - including the enhancement water table and reduction the extraction cost of groundwater.

2.3 Factors Driving the Environmental Services Sector in Asia

The environment goods and services market in Asian developing countries has experienced double digit growth, due to increasing demand for environmental services, technology and equipment. Urbanization, enhancement of domestic environmental regulations, and globalization are the critical factors behind this growth, besides demographic conditions. The demand factors behind the growth of the environmental services sector in these Asian countries can be categorized as follows:

- (i) *Size of population and its purchasing power:* The need for potable water and sanitation services is growing with the ever growing population in Asia. Moreover, a large pool of the existing population in these countries remains without access to infrastructure environmental services. For example, in Philippines only 7% of the total population is connected to sewer systems and few households have on-site sanitation facilities (World Bank 2003a)⁷. However, a major challenge in developing the market for these services in Asia is the low purchasing power of the population. Extensive poverty even within countries which have been experiencing considerably growth in the last decade (like India) limits the purchasing power of the potential consumers and hence the realized market demands for these services.
- (ii) *Stringency of environmental regulations:* Environmental protection policies, especially instruments which enforce polluter-pay-principle increase the demand for environmental technology and services. The environmental regulatory institutions in Asian countries have been strengthened though the 1990s, and some have moved beyond pollution abatement policies towards pollution

⁶ Primary forests have been defined by the FAO as forests of native species where there are no clearly visible indications of human activities and where the ecological processes are not significantly disturbed.

⁷ However, the access to "improved sanitation" as reported by the Philippines government is 73%, since the term is broadly defined (see Table 3), and holds even when there are no sewer connections.

prevention instruments (see section 3.2). Implementation of waste reduction policies has prompted industrial polluters to move towards cleaner production. For instance, in Korea, the emphasis to reduce and recycle wastes, has succeeded in bringing down the generation of waste at source, and increasing the demand for environmental services for clean technology as well as recycling services. Regulations directing local urban bodies to collect and safely dispose of household wastes also significantly increase the demand for infrastructure environmental services in solid waste management, as evident in India recently.

- (iii) *Degraded state of the environment:* Industrialization and urbanization in Asian developing countries has led to a host of environmental problems including land degradation, deforestation, loss of freshwater and air pollution. For example, in the Philippines, only a third of the river systems are classified as suitable sources of public water supply; and 58% of groundwater is contaminated with coliform and requires treatment (ADB 2005a). Environmental pollution damage is quite extensive even in the relatively rich Asian countries: for example over 40% of Chinese Taipei's rivers are polluted with industrial and municipal wastewater.⁸ While the extent of pollution damage potentially creates demand for industrial remediation / resource recovery services, it also means that the supply costs of providing certain other environmental services like the provision of clean water are increasing.

On the other hand, the factors affecting the supply side of the developing environmental services markets in these countries are the following:

- (i) *Government commitment and investment:* Environmental services like water purification, wastewater treatment and household solid waste management services have typically been in the realm of public sector infrastructure services, since they require the largest investment (more than a third of the public sector capital expenditures in developed and developing countries is spent on water treatment, WTO 1998). Increased government commitment to improve the provision of basic environmental services and public investment enhance the supply capacity of the sector. Most notably, over the last few years the Chinese authorities have set ambitious numerical targets to improve basic environmental services, and increased public investment (see section 3.3).
- (ii) *Capacity of the domestic environmental service firms:* Countries which have a well developed environmental industry have better supply capacity to provide environmental services. Among emerging Asian economies, Korea and Chinese Taipei (and to a lesser extent Malaysia), which have the best environmental service provision, also have the most developed environmental domestic industry

⁸ *Chinese Taipei Environet*, <http://proj.moeaidb.gov.tw/environet/e-04envr05-0112.asp>. Accessed February 1, 2006.

(although they continue to import environmental technology from the Japan, US and the EU).

- (iii) *Open economic policies to supplement the gap in domestic supply:* During the last fifteen years, Asian countries have encouraged private participation and foreign investment in the traditional public sector services, including water, sewage, and sanitation services. In particular, Malaysia, Indonesia, Thailand, and Philippines began privatization in the early 1990s. In the Philippines, contracts for water and sewerage services for the city of Manila were awarded to two private consortia, and in Indonesia a 25-year build and operate contract for a drinking water treatment plant in the city of Medan, Sumatra, was awarded to a French company. Foreign investment was expected to bring in essential capital as well as state-of-the-art technology from mature environmental markets, which the domestic public sector otherwise lacked.⁹

Need to Build Supply Capacities Jointly in Environmental Services with Spillovers

When discussing the development of the environmental services sector in Asia, it is important to note that capacity building in several segments jointly is critical. While, environmental services segments are considered separately, they are part of the same ecosystem, and thus the costs of neglecting one segment immediately affects the costs and benefits of another environmental services segment. While Asian countries have been promoting capacity-building in water, wastewater, solid waste, air pollution management services, they have often done so without taking into consideration the inter-dependent nature of environmental capacity within a local ecosystem. Thus a city municipality may be improving piped water supply with the help of private participation, but not investing in improving solid waste management in the same budget period. In the medium and long run however, it only increases the costs of service provision.

Consider the case of potable water, where the supply costs are directly related to the extent of contamination of freshwater sources. The contamination of freshwater, surface or ground depends on the extent of disposal of untreated solid wastes and waste-water into open areas/ drains or rivers that contaminates groundwater (through leaching) and streams/ rivers. When efforts are made to develop water utilities in a local ecosystem alone while neglecting wastewater and solid waste disposal occurring in the same region, it increases the cost of providing potable drinking water. If, however, the creation of supply capacity in the water sector is addressed in conjunction with building the capacity for solid-waste and wastewater treatment (*in the same local ecosystem*) then such spillover costs can be avoided.

⁹ However, in the last few years, large multinational companies from industrial countries have begun to reduce their investment in infrastructure services sector in Asian developing countries. These companies are now focusing on developing countries in Central and East Europe and selected Asian countries, like China. (see Table A.4 for regional distribution of MNC projects in water and sanitation).

2.4 Current Capacity in Basic Environmental Services

This section focuses on water, wastewater treatment and solid waste management services given that these are the largest environmental services segments in Asia. In particular, sewerage/ sanitation and municipal waste services are looked at here as they are part of the basic infrastructure services which governments began opening to private participation in the 1990s. They are therefore the most significant sectors for international businesses and in the context of the GATS negotiations.

The gaps in the supply capacity of these basic services in Asia are evident from the current under-provision of infrastructure services in developing countries. Large populations, both urban and rural, remain without piped water and sanitation facilities, making these the highest potential growth market segments.

2.4.1 Water and sanitation

Asia has the highest number of people unserved by water supply (about 700 million), or sanitation (1.9 billion), in the world. In 2000, only 49% of the Asian population had water access through household connection, another 30% had access to a nearby improved facility, while 19% remained unserved.¹⁰ Access to sanitation is even more limited, with only 18% of the total population having house connections to sewer systems, 29% having access to improved sanitation nearby, while 53% remained unserved.¹¹

Based on the individual government reports, the provision of basic environmental services is by far the best in Korea and Malaysia, while it is particularly lacking in China, India, Indonesia and Vietnam. It should be noted, however, that within a country, the provision of water, sanitation, and solid waste management services is rather inequitably distributed, with urban population getting better coverage compared to the rural population. Inequitable distribution exists even across urban centres, with major cities getting better provision than secondary cities, where less investment in infrastructure takes place. Table 3 provides a summary of the data (based on World Development Indicators 2005).

A more realistic estimation by a recent study shows that the effective urban population covered by improved water (piped water) in Asian cities is much lower than the figures quoted above. For instance, based on total household water connections and assuming five persons per household, the populations covered in selected cities in 2001 were as follows: Bangkok 72%, Delhi 46%, Ho Chi Minh City 32%, Jakarta 31%, and Manila 32% (McIntosh 2003: 25).

¹⁰ UNESCO 2003: Table 5.3

¹¹ Ibid.

Table 3. Population Provided with Water and Sewerage Services in 8 Asian Countries, 2002

Country	Access to improved water [#]			Access to improved sanitation [@]		
	% Total pop	% Urban pop	% Rural pop	% Total Pop	% Urban pop	% Rural pop
China	77	92	68	44	69	29
India	86	96	82	30	58	18
Indonesia	78	89	69	52	71	38
Korea	92	97	71	-	-	-
Malaysia	95	96	94	-	94 ^a	98
Philippines	85	90	77	73	81	61
Thailand	85	95	80	99	97	100
Vietnam	73	93	67	41	84	26

[#]An improved source of water includes a household connection, public standpipe, borehole, protected well or spring, or rainwater collection. Unimproved sources include vendors, tanker trucks, and unprotected wells and springs. Reasonable access is defined as the availability of at least 20 liters per person per day from a source within one kilometer of the dwelling.

[@] Access to sanitation for total population is for 2002, but the urban and rural data pertains to the year 2001. The definition of urban areas and access to improved sanitation vary across countries, so comparisons between countries can be misleading. Improved facilities range from simple but protected pit latrines to flush toilets with a sewerage connection. ^a For the year 1990

Source: Tables 1.3, 3.5, and 3.10, *World Development Indicators 2005*

2.4.2 Municipal Solid Waste Management

As noted earlier, in developing Asia population growth and urbanization have increased the challenges in dealing with municipal solid waste management services. Moreover, solid waste generation increases with income, thus the issue is as much a challenge for the more advanced countries. While in poorer countries collection and disposal remain the main problems, the more industrialized countries like Korea and Chinese Taipei have started to focus on reducing waste generation.

Proper disposal of municipal waste is particularly lacking in China, India, Indonesia, Malaysia, Philippines and Vietnam, where open dumping is the predominant method adopted. In India, Indonesia, Philippines and Vietnam, more than half the municipal waste is openly dumped creating unsanitary conditions. In China and Malaysia about half the municipal waste is openly dumped (see Table 4).

The levels of municipal solid waste management services are by far the best in Korea and Chinese Taipei. In Korea, landfill is the predominant method of disposal, while most of Chinese Taipei's municipal waste is incinerated, followed by sanitary landfills. In recent years, the Chinese Taipei government has also made progress in recycling. Segregation of municipal waste has been successful in encouraging food wastes to be directly recycled for pig feed and composting (see Table 4).

Table 4. Municipal Solid Waste Generation and Disposal Methods in 9 Asian Countries

Country	MSW (kg/capita/day)		% municipal solid waste disposed by each method				
	1999	2025 (estd)	Landfill	Open dumping	Composting	Incineration	Other
China	0.79	0.9	30	50	10	2	8
India	0.46	0.7	15	60	10	5	10
Indonesia	0.76	1.0	10	60	15	2	13
Korea	1.59	1.4	60	20	5	5	10
Malaysia	0.81	1.4	30	50	10	5	5
Philippines	0.52	0.8	10	75	10	-	5
Chinese Taipei*	1.10	-	20**	0.2	0.8	57	21#
Thailand	1.10	1.5	-	-	-	-	-
Vietnam	0.55	0.7	-	70	10	-	20

Source: Figures 3 and 7 World Bank (1999); Table 17 World Bank (2003) for disposal data - corresponds to 1997.

*Disposal percentage calculated by author based on 2004 data in “Chinese Taipei Clearance of Municipal Solid Waste”, website <http://edb.epa.gov.tw/eng/EnvStatistics/GarbageRecycle/indexGarbage.asp#>. **19% is sanitary landfill, and 1% is general landfill. #18% is recycled by implementing agency, and 3% is pig feed from food waste.

3. Domestic Policy Measures and Environmental Services in Selected Countries

With increasing integration into the global economy, developing countries have adopted major environmental policy changes, driven by political forces, economic agents, and civil society. Stringency of national regulations on environmental quality and good enforcement pushes polluters to demand environmental services, including clean technology and waste management services. Moreover, greater participation of a country in international, regional or even bilateral environmental initiatives increases regulatory pressure to enhance, preserve and protect the environment. For example, the Agenda 21 commitments have encouraged governments to focus on increasing the provision of basic environmental services like water and sanitation.

3.1 Participation in Multilateral and Regional Environmental Initiatives

The active participation of Asian developing countries in global environmental initiatives has been closely followed by the establishment of their national environmental institutions and strategies. All the sovereign countries discussed in this paper have ratified the major multilateral environmental agreements that contain specific trade obligations, like the Convention on International Trade in Endangered Species (CITES), the Montreal Protocol on Substances that Deplete the Ozone Layer, and the Cartagena Protocol on Biosafety. Table A6 shows the ratification status of these Asian countries (except Chinese Taipei, since its legal sovereignty is associated with China) in six multilateral environmental agreements with trade obligations.

Following the 1972 Stockholm Conference on Human Development, the Environmental Protection Office under the State Council was set up in China in 1974. Similarly, in India

a systematic set of domestic pollution control laws began to be established starting with the Water Act in 1974.

Analysts, however, consider developing countries to suffer from policy incoherence since environmental and trade objectives are not integrated. On the one hand, negotiators from these countries typically oppose new trade-related environmental measures while on the other hand their counterparts in environment ministries argue for stricter trade restrictions in certain agreements like the Basel Convention and the Cartagena Protocol (Brack and Branczik 2004). However, the phenomenon of the lack of integration between environmental policy and economic is common to both developed and developing countries, albeit more pronounced in the latter.¹² The economic medium-term goals related to the promotion of growth, employment, trade and investment continue to command priority over environmental issues among most national governments resulting in policy incongruity.

In East Asia, Korea and China have been strong promoters of regional environmental initiatives that directly impact the development of the environmental industry of the region. China and Korea began a bilateral cooperation program in 2001 to help develop the Chinese environmental industry rapidly. The program called *Korea-China Environmental Industry Centers* promotes technology exchange through pilot projects in selected Chinese provinces and cities. According to the Ministry of Environment, Republic of Korea, about US \$2 billion of exports to China were achieved by twenty Korean environmental companies. During the 2003 Korea-China Summit the two countries agreed to strengthen bilateral environmental industry cooperation and host environmental industry forums.

Development of environmental technology has also been promoted at the trilateral level between China, Korea and Japan with annual Environmental Industry Roundtables since 2001. There is also a new regional Asia-Pacific initiative called the *Seoul Initiative on Environmentally Sustainable Economic Growth* (Green Growth), which aims to promote private sector participation in environmental infrastructure investment and increase the demand for better quality of environmental goods and services. Cooperation with Japan is significant in encouraging the transfer of state-of the art environmental technology.

¹² It must be added, however, that environmental provisions in new agreements under the WTO (especially the Agreements on Technical Barriers to Trade and Application of Sanitary and Phytosanitary Measures) also prompted developing country government to issue guidelines on the production processes and certification for exports consistent with the environmental provisions. Thus, trade liberalization has played a role in increasing environmental institutions within the trade sector in developing countries even if only to maintain access to major export markets in industrialized countries.

3.2 Domestic Legislation Impacting Environmental Services

(i) China

As noted earlier the environmental legislative framework in China took off in the 1970s. The strengthening of the institution over the years directly impacts the development of the domestic environmental services and clean technology. For instance, Article 25 of the *1989 Law on Environmental Protection* contains that all new enterprises or existing enterprises renovating their technology should use equipment and processes which have high efficiency of resource use and generate less waste. Similarly, Article 22 of the *1996 Law on Water Pollution Prevention and Control* dictates that enterprises should adopt cleaner production technologies to achieve higher efficiency of resource use and to generate reduced levels of pollutants.

A one of a kind national law establishing clean production technology called the Cleaner Production Promotion Law came into effect in January 2003. More recently, legislation on solid waste management, *The Law of People's Republic of China on Prevention and Control of Pollution by Solid Wastes* came into effect in April 2005.

China has built a cooperative environmental program with the OECD countries, which began with a dialogue on environmental policy issues of mutual interest to these countries in 1996. In recognition of mutual benefit, the Chinese State Environmental Protection Administration (SEPA) and the Environmental Directorate of OECD signed a memorandum of understanding in December 2003 to develop efficient and effective environmental policies to foster sustainable development.

(ii) India

The basic environmental protection legislation was laid down post-1972. The environmental regulations that followed focused on prevention and control of pollution from the industrial sector and protection of forest and wild life. Preparation for the 1992 UN Conference on Environment and Development led to the *National Conservation Strategy and Policy Statement* and the *Policy Statement on the Abatement of Pollution* to build more efficient environmental policy instruments.

A recent legislation which directly affects the provision of environmental services is the *Municipal Solid Wastes (Management & Handling) Rules, 2000*. It is interesting to note that public litigation, which has been a major factor of environmental enforcement and booking of polluters, led to its development.¹³ The case of people pushing reforms through

¹³ Following a Supreme Court case by Almitra Patel, the Municipal Solid Waste Management Rules 2000 were framed with a compliance schedule: municipalities were to set up waste processing and disposal facilities by December 2003; and improving the existing landfill sites by December 2001.

the judiciary continues in India, and in 2004 the Supreme Court Order upheld the example of high performance by two urban local bodies in small towns stating:

“It is necessary and appropriate to make a beginning that an action plan for management of MSW in respect of metro cities and States capitals is prepared by Ministry of Urban Development in consultation with all concerned, including, Ministry of Environment and Forest and the Central Pollution Control Board so that the implementation, based on the said plan, can commence without any further delay in the State capitals and metro cities to be followed by other cities... *Lack of funds is no excuse for inaction. Smaller towns in every State should go and learn from Suryapet in AP (pop.103,000) and Namakkal in TN (pop 53,000) which have both seen dustbin-free “Zero Garbage Towns” complying with MSW Rules since 2003 with no financial input from States or Centre, just good management and sense of commitment.*” (Emphasis added, Order of the Supreme Court on Management of Municipal Solid Waste, 5th Oct 2004)

The regulations related to basic infrastructure environmental services and industrial pollution control are quite elaborate, but implementation is still a challenge. The Supreme Court has played a key role in India in enforcing legislation through the 1990s and continues to do so.

(iii) *Indonesia*

During the 1990s, the Ministry of Environment introduced a large body of environmental management regulations, especially on water and solid wastes. These legislation focused on pollution abatement the industrial sector for hazardous wastes and reducing pollution of the natural resources (for example clean river programme *PROKASIH* initiated in 1989).

In 2001, wastewater from household was classified as a water pollutant with the *Water Pollution Control Regulation*. Municipalities are responsible for managing household waste, and decentralization has given them the freedom to plan and manage environmental services, construction, and operation of central treatment facilities for wastewater.

(iv) *Korea*¹⁴

In Korea, environmental legislation started in the early 1960s and the domestic environmental market began to grow in the late 1970s. The early regulatory framework has been strengthened over the years through amendments or new legislation. For example, the 1961 Waste Cleaning Act and Water Supply was repealed and replaced by the 1986 *Waste Control Act*, while the 1963 Environmental Pollution Prevention Act was replaced by the *Environmental Conservation Act* of 1977 (repealed 2002). There is an ongoing effort to improve the environmental framework by integrating legislation on similar issues: the two laws on sewage, namely Sewerage Act 1966 (amended 2002), and

¹⁴ This information has been compiled from the Ministry of Environment Republic of Korea website <http://eng.me.go.kr/user/index.html>.

the Act on the Disposal of Sewage, Excreta & Livestock Wastewater 1991 (amended 2004) are to be integrated to set up a uniform system of sewage management across all urban areas.

The reduction and safe treatment of waste has been a major policy issue in Korea. In 1995, Korea introduced a volume-based waste fee system on household wastes. According to the Korean Ministry of Environment, the price system has succeeded in substantially reducing the volume of household wastes. Although the total amount of waste generation has gradually increased since 1999, per capita per day waste generated was reduced from 1.3kg in 1994 to 1.04kg in 2002. Also, the recycling rate of municipal waste increased from 26.2% in 1996 to 44.0% in 2002, accompanied by a decline in the rate of land filling from 68.3% to 41.5% in the same period.

The Korean environmental framework has progressed from the polluter-pays-principle to the pollution-prevention-principle for the industry. The *Extended Producer Responsibility System*, introduced in 2003, (replacing the previous policy of Waste Deposit-Refund System) promotes waste reduction, reuse and recycling. Under the new system producers are responsible for meeting recycling targets. It has been successfully implemented in more than 15 items, including glass bottles, packaging film, fluorescent light bulbs, and electronic products like TVs and computers. Voluntary and government efforts are also promoting environmental awareness to reduce the use of disposable products like plastic bags and encourage the use of cloth bags for shopping.

Korea is now encouraging the advancement of environmental technology and recently enacted the *Development of & Support for Environmental Technology Act* in 2004.

(v) *Malaysia*

Malaysia began environmental planning legislation early in the twentieth century with the 1920 *Waters Act* and 1954 *Drainage Works Act*. The framework for environmental legislation, however, was set up in the 1970s with the 1974 *Environmental Quality Act* and the establishment of the Department of Environment in the same year. The accompanying regulations of this Act cover environmental impact assessment, project siting evaluation, pollution control, monitoring and self-enforcement. The 1996 amendments strengthened the Act by increasing the penalty fines and prison terms for polluters and granted greater authority to the Department of Environment to book violators.

Malaysian legislation in environmental service privatization has been accompanied by award of contracts to domestic consortium. In 1991, the management of Scheduled Wastes was privatized with the incorporation of Kualiti Alam Sdn Bhd. The company was awarded a 15-year exclusive contract to operate the waste management system for Peninsular Malaysia on a fully commercial basis in 1995. Under the concession agreement, all off-site treatment and disposal (incineration, storage and secure landfill) of scheduled wastes are not allowed until after 17 December 2010.

Similarly, the government privatized the sewerage services in 1993 with the landmark *Sewerage Service Act*, along with the concession contract to the Indah Water Konsortium. The Malaysian consortium took over services for 84 local authorities (out of the total number of 144) in the country.

To promote an integrated water resource management system, the National Water Resources Council (NWRC) was set up in 1998. In 2003, in order to improve the national water sector, NWRC proposed the Federal Government involvement in the management of water resources and water supply services in the states and the formulation of Integrated River Basin Management Master Plans for all river basins nationwide.

(vi) *Philippines*

Setting up of the main environmental legislative framework in the Philippines began in the 1970s, including several presidential decrees that established the framework for infrastructure environmental services in water and sanitation such as the presidential decrees of the Creation of Provincial Water Utilities in 1973, Sanitation Code in 1975, Water Code in 1976 and National Building Code in 1977. However, these regulations have not been strictly enforced, and sewerage services remain poor in the Philippines (World Bank 2003a). The Philippine Agenda 21 of 1996 prioritized the provision of sanitation and sewerage services but government investment has been relatively low. On the other hand, there is greater enforcement of industrial pollution regulations, especially of large firms, and the government has also implemented market-based instruments like effluent charges in the 1990s.

In 2003, the Department of Environment and Natural Resources, the principal environment and watershed agency, introduced a nation-wide Environmental User Fee System¹⁵ to efficiently reduce water pollution at source. The user fee system applies to all establishments and installations which discharge industrial and commercial wastewater into water and/or land resource, and is expected to encourage the adoption of clean technology while reducing total pollution load.

More recently, the *Medium Term Philippine Development Plan* (2004-2010) set targets to achieve environmental services provisions, especially for potable water supply.

(vii) *Chinese Taipei*¹⁶

Chinese Taipei too started its environmental legislative framework in the 1970s, which which was strengthened over the years through amendments and new regulations. For example, legislation on 'water for human use' (as per GATS parlance) includes the 1972

¹⁵ The fee is a two-part tariff, consisting of a fixed fee based on the volume of discharge and a variable fee based on the unit load pollution.

¹⁶ Information on Chinese Taipei's environmental laws compiled from <http://law.epa.gov.tw/en/>.

Drinking Water Management Act (last amended 2003), the *Drinking Water Quality Standards* of 1998 (last amended 2005), and the *Drinking Water Management Act Enforcement Rules*, enacted in 1998. The latter made the central and local government bodies responsible for drinking water management. Similarly, the respective responsibilities of the central and local government bodies (rural and urban) in management of solid waste are designated by the 2001 *Waste Disposal Act Enforcement Rules* (amended 2002).

As in Korea, the new regulations in Chinese Taipei such as the *Resource Recycling Act* of 2002 and several accompanying rules enacted in 2003 are aimed at reducing waste and encouraging recycling. In December 2004, the Environment Protection Administration introduced a new policy of segregating household waste at source into recyclable food leftovers and general waste, with the objective of reducing waste by 25% in 2007 from the baseline year of 2001.¹⁷

In December 2002, the government enacted the *Basic Environment Act*, a separate legislation for sustainable development and public health. Significantly, this legislation allows the government to adopt preferential treatment in order to develop and encourage firms in the environment industry: “Government entities at all levels shall adopt preferential treatment and incentive measures to guide the development of environmental protection enterprises and private environmental protection groups, as well as encourage private investment in the environmental protection industry. The central government shall guide and manage environmental protection enterprises to raise the quality of environmental protection engineering and services.” (Article 36, Basic Environment Act 2002)

(viii) *Thailand*

The environmental governance structure in Thailand was established in the 1970s. Notably, the 1975 *Improvement and Conservation of Natural Environmental Quality Act* set up the National Environmental Board. The 1990s saw an increase in government commitment to environmental protection with amendments and strengthening of regulations and integration of environmental conservation into the Seventh National Economic and Social Development Plan 1991-96. In 1992, several new legislative acts took effect, including the *Factory Act*, *Public Health Act*, *Hazardous Materials Act*, and *The Enhancement of Energy Conservation Act*. These new environmental regulations enforced the polluter-pays-principle.

In 1992, the *Enhancement and Conservation of National Environmental Quality Act* replaced the *National Environmental Act* of 1975. The new Act established the Pollution Control Committee, introduced a system of designated pollution control areas, set up the Environmental Fund, established uniform nation-wide emission and discharge standards,

¹⁷ “Compulsory garbage separation starts soon”, from: <http://www.taipeitimes.com/News/Chinese/Taipei/archives/2004/12/20/2003215926>.

increased penalties for non-compliance, and encouraged the participation of environmental nongovernmental organizations.

The *Public Health Act* of 1992 empowered the local administrative bodies in sewage and waste management, allowing the local bodies to allow private participation in the provision of environmental services.

(ix) *Vietnam*

In Vietnam, a systematic environmental legislative framework was set up in the 1990s, hence more recently compared to the other Asian developing countries. The principal national body in charge of environmental policy management, the Ministry of Science Technology and Environment, was set up in 1992. New regulations introduced included *The Law on Protection and Development of Forests* in 1991 and *The Law on Environmental Protection* in 1994. In the new millennium, the government formulated the *National Strategy for Environmental Protection 2001-2010*.

3.3 Government Strategy and Spending in Environmental Services in 4 Countries

The government commitment to environmental protection and building domestic capacity in environmental services seems particularly marked in four of the emerging Asian countries, namely China, Korea, Malaysia and Chinese Taipei. On the other, in Indonesia public expenditure in infrastructure was reduced drastically during and after the 1997 economic crisis.

(i) *China*

The commitment of the Chinese government to improve environmental services is evident from its medium term plans and investment throughout the nineties. The government has been allocating an increasing proportion of its rapidly increasing GDP to environmental protection. In 1989, the government allocated about 0.72% of GDP to environmental protection, and by 2003 the amount had increased to 1.33% of GDP.¹⁸

In 1996, the government's *National Ninth Five Year Plan* and the *White Paper on Environmental Protection* laid out environmental goals for the country before the new millennium, as well as a longer term target for the year 2010. By the year 2000, the goal was to establish:

“by and large a fairly perfect environmental management system and an environmental legal system that conforms to the socialist market economy... bring the worsening trend of environmental pollution and ecological destruction basically under control, improve the environmental quality of some cities and regions, and establish a *certain number of demonstration cities and regions characterized by*

¹⁸ <http://www.china.org.cn/english/features/China2005/142218.htm>.

rapid economic development, clean and beautiful environment and benign ecological circle.”

(9th 5-year Plan, emphasis added)

The government's long term strategy has been to improve the environmental management systems in place and reverse ecological deterioration on the whole by 2010. The Ninth Plan earmarked investments of US\$54 billion or 450 billion Yuan for pollution control, in addition to funds for afforestation and other ecological construction projects. Out of this amount 200 billion Yuan were earmarked for new/ extension/ and renovation projects, 105 billion Yuan for the treatment of old pollutant sources; and 145 billion Yuan for the construction of urban environmental infrastructure.¹⁹

The Tenth National Five-year Plan for 2001-2005 increased the allocation for environmental expenditure to US\$84 billion (700 billion Yuan) , accounting for about 1.3% of GDP during the same period and about 3.6% of the total fixed investment for the economy.²⁰ In particular, the plan aimed at promoting the domestic environmental industry, setting a target growth of 15% per annum on an average over the next five years, in order to increase the size of the industry to 200 billion RMB Yuan (*US\$ 24 billion*.) by the year 2005. The goal was to develop advanced environmental protection technologies conforming to international standards, and to nurture a few big players in the market:

“By 2005, establish 3 to 5 large-scale environmental protection companies and enterprise groups with international competitiveness. Develop a number of small and medium-sized environmental protection enterprises with technological advantages that provide large-scale companies and enterprise groups with services that are new, distinctive, specialized and sophisticated. Provide support for a number of environmental service enterprises so as to improve the level of socialized services for the environmental protection industry”

(10th 5-year Plan, emphasis added)

Besides the five-year plans, the China Environmental Protection Administration also promotes the supply capacity of environmental services. Under the latter's master plan, 31 major regional hazardous waste (including medical wastes) treatment facilities are to be built in urban China. Multinational environmental service providers like Onyx have successfully bid for concession agreements with the government for such treatment plants, sometimes through joint ventures with Asian partners.

(ii) *Korea*

In 1999, the government spent US\$ 3.9 billion on environmental infrastructure construction and management, which accounted for 55% of Korea's total environmental expenditure.²¹ Remarkably, Korea's environmental expenditure of 1.5% of its GDP was

¹⁹ China's Ninth Five Year Plan Summary, website: <http://www.zhb.gov.cn/english/plan/Ninep.htm>

²⁰ China's National Tenth Five Year Plan Summary, <http://www.zhb.gov.cn/english/plan/Tenth.htm>.

²¹ US-AEP (2002: 3).

comparable to that of other OECD countries in 2000.²² Moreover, to develop the domestic environment sector the government has followed strategic policies. For example, in order to encourage investment in pollution abatement in the industrial sector, an environmental fund was established in 1983, which primarily provided cheap credit for firms investing in control technologies and for operators of private environmental facilities like sewerage treatment plants. To boost demand for domestic environmental equipment, the investment tax credit offered on the value of the investment was 10% for Korean made equipment (3% otherwise) to facilities increasing productivity, energy saving, preventing industrial hazards etc. (O'Connor 1995: 15, World Bank 1995: 69).

In 1992, the Ministry of Environment began to encourage the development of Environmental Sound Technologies (ESTs) through a financial fund. The fund supported environmental improvement of facilities of old factories, establishment of recycling industries, research and development of the ESTs, and commercialization of pilot phase technology through soft loans and grants. The amount disbursed through the fund increased from \$0.4 million in 1994 (US\$) to \$0.9 million in 1998 (Lee 2002).

More recently, in 2001 the government adopted a two-phase Environmental Industry Development Strategy, a short term strategy for 2001-2003, and a Mid- and Long-term Strategy on Fostering Environmental Industry for 2005-2010. A ten-year *Eco-Technopia 21 Project*, with the twin goals of enhancing the level of the domestic environmental technology (in 12 areas including clean air and drinking water), and find solutions to new environmental problems was initiated in 2001 by the Ministry of Environment.

A cumulative investment of US\$ 1.03 billion (1 trillion Won) has been planned in the Eco-Technopia project. The government investment in the first year amounted to 50 billion won from the national treasury. This support is expected to give a boost to the development of environmental technologies for export, resource remediation, and public infrastructure.

(iii) Malaysia

Environmental protection has been a feature of Malaysian economic plans since the 1970s. Beginning with the 3rd five-year plan (1976-80), environmental policies have been integrated into the development planning process. The government has invested in particular in the area of water supply and treatment in the plans, and this has been an important factor driving the environmental services sector. In the *Sixth Malaysia Plan* (1991-1995), the government allocated \$1.5 billion for water resource development. In 1994, the government announced plans for the *National Solid Waste Management Program*, with a 20-year privatization contract, estimated to cost \$3 billion.

The government also set targets for the provision of environmental services under its economic plans. In particular, under the 7th Plan in 1996, the government set a goal to

²² O'Connor (2004:14).

ICTSD

extend the coverage of safe drinking water to 95% of the population and to increase the hookup rate to adequate sewer systems to 79% by the year 2000. In the most recent budget of 2006, the government has allocated US\$ 0.54 billion to environmental protection, of which \$283.1 million is earmarked for the repair of existing sewerage plants and the construction of new plants, and \$103.7 million for solid waste management.²³

Private participation in essential environmental services began in 1989, when the government gave development or management concessions on a build-operate-transfer basis to Malaysian enterprises that were part- or majority-owned by either French or British water operators. The contracts covered treatment plants or bulk water supply, while distribution remained under local control. To improve efficiency from source to consumer Malaysia also began state ownership of incorporated water utilities: in 1994, the Johor State Water Department became the first state water authority to be incorporated (renamed Syarikat Air Johor Sdn. Bhd.); in 1995 the Water Supply Division of the Kelantan Public Works Department was privatized and renamed Kelantan Water (M) Sdn. Bhd, jointly owned by YAKIN, a subsidiary of the Kelantan state government, and Thames Water of the United Kingdom.

(iv) Chinese Taipei

The government identified the environmental industry as one of the potential emerging industries in the 1990s, and began to develop Chinese Taipei into a major exporter of environmental equipment and service exporter in the Asia Pacific region. In 1999, the Industrial Development Bureau of the Ministry of Economic Affairs drafted a strategic plan for the development of Chinese Taipei's environmental technology industry, to reinforce promotional efforts, and strengthen its structure and quality.

In 2000, the government spent US\$1.2 billion on waste management, and R&D. Solid waste clearance and treatment accounted for the largest expenditure due to the large budgets for municipal waste disposal.²⁴ To boost the demand for environmental equipment, the government has a special development fund which provides low-interest loans to small and medium-sized enterprises to upgrade and purchase pollution control or treatment equipment. Moreover, companies investing in recycling and pollution control equipment or technology can get tax benefits (5%-20% of the amount invested can be deducted from the income tax over a five-year period, beginning with the year in which the investment is incurred).

4. Trade Regime for Environmental Services

International trade in environmental services takes place through foreign investment (GATS Mode 3 for commercial presence) and is also closely tied to trade in environmental

²³ Market Watch Malaysia 2006: Environmental Sector, Malaysian-German Chamber of Commerce and Industry, <http://www.mgcc.com.my/mgcc/main.nsf?OpenDatabase>.

²⁴ (<http://www.environment.org.tw/e-04envr05-0112.asp>)

equipment and technology. Thus the openness of a country's trade regime in environmental services is determined by both general and sector-specific foreign investment requirements (e.g. engineering and construction sector relevant for building waste treatment facilities); and its duty structure for environmental equipment. Within the general investment policy, regulations on the level of foreign ownership and licensing requirements for foreign company operations in sensitive areas of public services (water and sanitation) are especially important. This section looks at the extent of trade openness and the foreign direct investment flow to the Asian countries, especially in of water and sanitation services.

The "Asian tigers" Korea and Chinese Taipei (Hong Kong and Singapore being the other two) began aggressively pursuing open-economy export-oriented policies in the 1960-70s; followed by Indonesia, Malaysia, Philippines and Thailand in 1980s; while China, India and Vietnam committed to trade and investment liberalization in the 1990s. Foreign investment in environmental services increased substantially in the 1990s in South East Asia. In recent years, however, foreign investment in infrastructure services waned in Southeast Asia following the decline in economic confidence with the 1997 financial crisis. Failures in water services projects resulted in a shift in investment away from Asian developing countries by the major environmental corporations (see Table A3 for regional distribution of investment in developing countries of companies including Suez, Veolia, and RWE Thames).

Measuring openness in terms of the share of trade in goods and services relative to domestic production, it is highest for Malaysia, moderately high for Thailand, Vietnam and Philippines; and moderate for China, Korea and Indonesia. India is the least open relative to the other countries (see Table A4).²⁵ In terms of tariff barriers on the import of environmental goods in emerging economies, an OECD survey in 2000 estimated the average applied MFN tariffs to be 18%. Among the Asian countries studied, Malaysia and Indonesia had the lowest applied rates of 6-7%, while India had the highest of 61% (O'Connor 2004:15).

The increasing liberalization in developing Asia has been accompanied by a steadily growing flow of foreign direct investment (see Table A2). In 2004 the total FDI inflow to Asia was \$148 billion, with China being the third largest recipient of FDI in the world after the US and UK (UNCTAD 2005). In particular, the outlook for FDI growth is more positive for the services sector than for the manufacturing or primary sectors, and this growth is expected to be led by services like computing and information-communications

²⁵ There is increasing evidence that a greater degree of openness in developing countries has increased environmental policy formation, which in turn creates greater demand for environmental goods and services. Fredriksson and Mani (2001) found that trade integration is a significant factor responsible for increasing environmental stringency in a sample of 50 developing countries. A study on developing countries including China, illustrated that national governments tend to tighten regulation as incomes grow (Wheeler 2001). Indeed the post-liberalization period in India has witnessed significant changes in terms of new environmental legislation, increase in cleaner exports, environmental certification among industries and the subsequent growth of the environment industry.

technology, public utilities (such as the generation and distribution of electricity, water and gas), transportation, etc. (UNCTAD 2005a)

The inflow of foreign direct investment has played a significant role in gross fixed capital formation of the smaller Asian developing countries (see Table A4 for shares in 2004). Over the last decade, the ratio of FDI inflow to total fixed capital formation has been the most significant in Malaysia and Vietnam (more than 10%), but less in the Philippines and Thailand.²⁶ Among the larger economies, FDI inflow has begun to play a more significant role in capital formation in China (10% in 2001-02), but is not significant for Korea and India. In Indonesia, FDI collapsed after the financial crisis, despite the government maintaining a relatively open investment regime.

The extent of liberalization in environmental services is indicated by the equity restrictions for FDI in the infrastructure sector. In this regard, Malaysia has consistently followed open economy market policies. In Malaysia, the Foreign Investment Committee allows foreign equity participation of up to 70% (while the remaining balance of 30% must be allocated to Bumiputeras) but to promote certain strategic services 100% equity is allowed.²⁷ In comparison the Philippines is less open, with a foreign equity restriction of 40% in public utilities. Korea, although committed to enhancing environmental technology advancement through imports, follow policies to protect domestic industry and promoting exports.

In 2005, under the revised GATS offer, Korea removed all the market access restrictions in Mode 3 (for foreign commercial presence) in sewage and refuse disposal services.²⁸ Previously these two segments had restrictions on market access under Mode 3, limiting the number of operators for sewage services and requiring an economic needs test in refuse collection. Under the initial GATS offer, Thailand committed to restricted market access under Mode 3 with a 49% equity limitation.

In India, foreign direct investment in environment equipment and services (manufacture of pollution control equipment, sewage, refuse, and consultancy services) has been open under the automatic route with up to 100% foreign equity holding. In July 2005, the government completely opened up the environmental infrastructure services with 100% equity in “built-up infrastructure and construction development projects... including city and regional level infrastructure” under the automatic route.²⁹ In other words, central

²⁶ Based on data in *Country Fact Sheets* (UNCTAD 2005). Website accessed January 2006, (<http://www.unctad.org/Templates/Page.asp?intItemID=2441&lang=1>).

²⁷ Activities covered under the *Industrial Coordination Act 1975*, including the recovery of wastes through recycling, and activities granted incentives under the *Promotion of Investments Act 1986* are exempted from FIC equity 70-30 guidelines. “Guidebook on Key Services Supporting the Manufacturing Sector 2005”, Malaysian Industrial Development Authority: www.mida.gov.my.

²⁸ Republic of Korea “Revised Offer on Services”, WTO document TN/S/O/KOR/Rev.1, 14 June 2005.

²⁹ In case of construction development project, the condition is that the area be less than 50,000 sq. meters. The investment is conditional on a minimum size of US\$ 10 million for wholly owned subsidiaries and \$5

government approvals are not required for foreign investment in infrastructure services, reducing bureaucratic barriers.

Traditionally, China's service sector has been one of the most heavily regulated parts of the national economy - and one of the most protected, where foreign service providers are largely restricted to licensed operations that have limits on entry, and restrictions on the geographic scope of activities.³⁰ All services require official approval, and service providers (except consultants) are required to operate either through joint ventures or wholly-owned foreign enterprises (ibid).

As noted earlier water supply and distribution services (water for human use) are not included under the GATS environmental services definition, however foreign participation in bulk water supply is allowed in all the Asian developing countries discussed here. Some countries also allow foreign participation in distribution services, namely, Indonesia, Philippines and more recently China. Indonesia has allowed private participation in water distribution services since 1996. China, which prohibited foreign participation in water distribution services in 1995, opened the segment in 2002. In China, most foreign contracts have been joint venture with the provincial or municipal authorities that did not involve competitive bidding.³¹ In Philippines, the amendment of the BOT Law (1993) in 1998 allowed private participation in water supply (among other infrastructure development services including solid waste management, sewerage and drainage).³²

Foreign investment is also guided by the perception of international businesses. China and India are becoming increasingly attractive for multinational companies, which indicates that the trade and investment regime is perceived to be favourable. A recent survey of multinational corporations indicated that the top five global business locations in the world are largely in developing countries. China and India were the two most attractive global business locations.³³ While China has been one of the world's largest FDI recipients, it is remarkable that India with its modest FDI inflows and relatively less open economy is increasingly becoming attractive for international corporations.

4.1 FDI in water and sewerage services

Foreign direct investment in water and sewerage services has followed closely the trend to increase private participation in infrastructure services. Investment in water and sewerage services with private sector participation in developing countries witnessed rapid growth in the mid-1990s, but fell off sharply in the late 1990s with mounting discontent in Latin

million for joint ventures with Indian partners. Foreign Exchange Management Regulations 2005: Notification No. FEMA 136 /2005-RB dated July 19, 2005.

³⁰ US Commercial Guide FY 2003: China.

³¹ Castalia (2004).

³² Section 2 of Philippines *Republic Act 7718*, <http://www.botcenter.gov.ph/botlaw/index.htm>.

³³ The ranking is based on TNC responses to "the most attractive global business locations 2005-06" is as follows: China, India, United States; Russian Federation, Brazil, Mexico, Germany, United Kingdom, Thailand, and Canada. (UNCTAD 2005a).

American and East Asia countries that had led this growth. The average annual investment flows for water and sewerage projects declined from US\$4.2 billion in 1995-2000 to US\$1.9 billion in 2001-04 (World Bank 2005a: 2).

Water and sewerage services have witnessed the highest incidence of cancellations or distress among all infrastructure projects with private participation in developing countries. By December 2004, about 37% of the total investment flows for water and sanitation since 1990 in developing countries were cancelled or under distress (World Bank 2005b: 3) due to difficulties in setting and maintaining tariffs at cost-recovery levels. These difficulties reflect the political economy of infrastructure pricing, since infrastructure services like water are considered essential basic services to be provided at concession rates to the public at large but eventually need to be financed by consumers either through purchase prices or tax payments.

While the trend in investment in water and sewerage services in developing countries has been dismal overall, the trend in investment for wastewater treatment facilities fared better than water utilities. The annual average investment flows for water utilities in developing countries were diminished from US\$ 3.6 billion in 1995-2000 to US\$ 1.1 billion in 2001-04. The annual average investment in treatment plants (water and wastewater), however, witnessed a modest increase from US\$0.6 billion in 1995-2000 to US\$0.8 in 2001-04 (World Bank 2005a:3). The growth in investment treatment plants was led by China, which accounted for 40% of the total investment during 2001-04 (ibid). The rest was spread over Thailand, Mexico and Russia among others.

Water and sewerage services have been the main focus of both multinational environmental corporations as well as projects initiated by international agencies in emerging Asia. For instance, according to a company press release of Suez Environnement in 2001,³⁴ half the revenue of its group Ondeo in Asia was accounted for by water utilities (€813 million) while waste services accounted for 14% of revenue (€220 million).

The cumulative FDI in water and sewerage projects, including private-public partnerships from 1992 to 2004, has been the highest in the Philippines and Malaysia. In recent years, however, there has been no new investment in the sector in any of these countries, except China (see Table 5). The value of the projects which were cancelled or expected to be cancelled (in case of Philippines) are indicated in brackets in the last row. Most of the private investment projects have been for water. In sewerage, only five projects were given, four in China and one in Malaysia (the Indah Wastewater Urban Sewerage Rehabilitation Project, cancelled in 2000).

³⁴ Ondeo established its presence in Asia in 1950s with the establishment of Ondeo Degrémont in Indonesia. www.suez.com

Table 5. Foreign Investment in Private-Public Projects in Water and Sewerage in 7 Countries, 1992-2004 (US\$ million)

Year	<i>China</i>	<i>India</i>	<i>Indonesia</i>	<i>Malaysia</i>	<i>Philippines</i>	<i>Thailand</i>	<i>Vietnam</i>
1992	.	.	.	1555	.	.	.
1993	.	.	.	2332	.	.	.
1994	43	.	.	90	.	.	.
1995	61	.	.	10	.	153	.
1996	251	.	200	172	.	.	.
1997	125	.	172	.	5820	61	.
1998	92	.	500	.	.	.	39
1999	191	.	11	902	28	25	.
2000	22	216	.	31	.	21	20
2001	178	7	37	.	.	240	154
2002	1218	.	.	.	.	.	.
2003	444	.	.	.	.	.	.
2004	471	.	.	.	.	.	.
Total investment	3095 (-162)	223	923	5092 (-2351)	5848 (-4000)	501	213

Source: Compiled from Country Snapshot Reports for 1990-2004, Private Participation in Infrastructure Database, World Bank (<http://ppi.worldbank.org/> accessed January 2006). Value of projects cancelled or expected to be cancelled (Philippines) taken from Table C-1, Castalia (2004).

In Asia, the most common form of private-public partnerships has been build-operate-transfer (BOT) projects and concessions. For instance, of the total number of public-private projects during 1990-2002, 48% were concessions and 40% were greenfield or BOT projects³⁵, while only a small number were management contracts. The BOT projects have been prevalent for water supply projects in China, Malaysia and Vietnam, where the private firms built the new facility and sold water to the public water company, which in turn distributed water to consumers. Some countries do not allow foreign firm participation in water distribution services, a segment not included under the GATS environmental services.

Concession contracts in water supply have been used in Indonesia and Philippines, where the foreign operator was expected to bring in significant new investment to rehabilitate and expanded the existing public network. For example, the Metropolitan Water Supply and Sewerage System was a concession agreement covering the population of metro Manila, and in Jakarta, the regional water company (PDAM) signed cooperation agreements with multinational corporations Ondeo and Thames. However, financial concerns led to concerns whether the foreign operators would terminate the contracts. Questions have also been raised about whether services have improved with private participation.

Based on the current trend in infrastructure capital, a recent joint study estimated that annual investment and maintenance costs in developing East Asia for the period 2006-

³⁵ Castalia (2004). Concessions involve the public sector retains ownership of assets while the private entity operates the existing assets and finances new investment. In greenfield/ BOT projects private entity construct and operate a new facility and later transfer it to the government.

2010 would be about \$8 billion for the water sector and \$7 billion for sanitation services.³⁶ China was seen to account for the bulk of the total investment and maintenance needs in these countries: 79% of the investment in water and 64% of the investment in sanitation.

4.2 Import of environmental technology

All the nine countries discussed in this paper import environmental technology from the more advanced industries in EU, Japan, and US. China, Chinese Taipei, Korea, Malaysia, Thailand, Philippines and India are among the top 20 importers of environmental technology from the US (see Table 6 below). While Korea continues to import state-of-the-art technology from US and Japan, there is also a focus on exporting its domestic technology to developing countries in Asia.

Table 6. Asian Countries among Top 20 Importers of US Environmental Technologies, 2002-04
(US domestic export value in million US\$)

<i>US Export Rank Order, 2004</i>	<i>Country</i>	<i>2002</i>	<i>2003</i>	<i>2004</i>
5	China	754.3	1 151.9	1 694.1
6	Chinese Taipei	817.9	795.9	1 428.8
8	Korea	751.8	1 188.1	1 051.7
16	Malaysia	375.8	356.9	415.2
18	Thailand	162.6	200.1	267.3
19	Philippines	131.8	228.6	258.1
20	India	155.2	178.9	256.9
<i>Top 20 total</i>		<i>20 003.5</i>	<i>22 587.2</i>	<i>25 794.6</i>

Source: US Trade Statistics, website <http://web.ita.doc.gov/ete/eternfo.nsf/VWQFbySector>, accessed January 11, 2006.

5. Foreign Investment in Environmental Services: Experiences in Emerging Asia

Environmental service companies are cognizant of the political as well as social difficulties in raising prices of essential services like water and sanitation. To bypass these sensitive issues, build-operate-transfer contracts were seen as an attractive alternative to reap efficiency gains, where the private sector could design, construct and operate the water treatment facility, while the distribution and water tariff collection onus remained with the local government bodies. However, the experiences in Malaysia and India show that with this kind of arrangements, the local governments were faced with mounting deficits as payments to the private operator had to be made (under the contract) while water tariff revenue remained well below this cost. The state has had to depend on subsidy and or

³⁶ Infrastructure stock trends were estimated from panel data after controlling for economic growth and economic geographic variables for 8 countries in East Asia (China, Indonesia, Lao PDR, Malaysia, Mongolia, Papua New Guinea, the Philippines, and Thailand). The projected stock levels were then valued at best practice prices; while annual maintenance costs were estimated at a fixed rate of 3% of the stock value. For the other 13 countries, for which data was missing, the projections were imputed by indirect estimation methods (including Cambodia, Fiji, Kiribati, Marshall Islands, Federated States of Micronesia, Myanmar, Palau, Samoa, Solomon Islands, Timor Leste, Tonga, Vanuatu and Vietnam. World Bank 2005c: 70).

tariff hikes to rectify the situations. Not surprisingly, financial problems have been the cause of early termination or cancellation of several private-public partnership projects.

(i) *Financial Woes in Privatization: Water in Malaysia*

In 1993, the state of Sabah on the island of Borneo, gave 20 year contracts for treated water supply to the state water department to three companies, namely Jetama Sdn Bhd, Timatch Sdn Bhd and Lahad Datu Water Supply Sdn Bhd. The state department bought the water from the private suppliers; then distributed the water to customers and collected water tariff (price). The price of water has remained relatively low and services level high.

A recent survey showed that while the private companies have made profits in the water business, the state water distribution company has been incurring annual deficits amounting to \$100 million (McIntosh 2003: 151). The government has been funding all capital works through subsidies amounting to \$270 million, which seems unsustainable.

Joint ventures between the private and public sector did not succeed in Malaysia in the early 1990s: In 1995, the joint venture "Kelantan Water", between the Kelantan state agency of Malaysia and the UK firm Thames water, failed to carry out the infrastructure work as the latter had serious debt problems. Eventually, Thames Water agreed to sell its entire 70 percent equity to the state government.

(ii) *Water and Solid Waste Services in India: The Case of Upstream and Downstream Environmental Costs*³⁷

In 2000, the Delhi Jal Board granted a 10-year build-operate-transfer contract to Suez Degremont to design, build and operate a drinking water plant in Sonia Vihar. Degremont was to invest in building the facility and sell the water Delhi Jal Board, while the latter was responsible for providing raw water to the plant, distribute drinking water to the consumers and collect tariff. This project promised to bring in the advanced technology in treatment facility through the investment of the world's leading water companies. However, the problem for the government distributor remained as in the case of Malaysia above, namely of the water tariff revenue falling short of payments to the private company (especially since Delhi's water tariffs rates are considered to be quite low)

Yet, as the construction of the treatment facility began in 2000, another problem came up. The farming community from the neighboring state protested against the project, claiming risks of spillover costs and damages: The tapping and diversion of river water (river Yamuna) to supply raw water to Degremont would adversely affect the water available for farming and hence crop yields. This led to a water dispute between Delhi and Irrigation

³⁷ For water contract in Sonia Vihar information based on: Suez Company press release www.suez.com; *Times of India*, June 17, 2005 "Sonia Vihar plant a tough jinx to crack"; "Haryana accuses Delhi of Stealing Water" by Sandeep Joshi, *The Hindu*, March 6, 2005. For solid waste services, information based on: *Business Line* 27th November 1999.

Boards of its neighbouring states of Uttar Pradesh and Haryana. The latter alleged that Delhi constructed a canal near Wazirabad barrage through which the Yamuna water was being diverted to a nearby pump house, since failure to provide raw water to Suez would entail a fine of Rs 50,000 per day for the Delhi government.

The experience in Delhi has brought into question deeper issues of environmental sustainability and the allocation of scarce natural resources among competing uses: water needed for agriculture in a dry and arid region as well as for direct consumption by the rapidly growing urban population. A piecemeal private contract for building a treatment facility or to distribute water is unlikely to solve these larger questions, which can be solved only with a more integrated and thorough environmental planning taking into consideration ecological constraints.

In 2000, the Municipal Corporation of Chennai granted a seven-year service contract to Onyx (subsidiary of Veolia- formerly Vivendi, France) to collect, transport and dispose household and commercial wastes in three zones of the municipal area. In 2002, however, Chennai Environmental Services Onyx was served a notice by the Tamil Nadu State Pollution Control Board for dumping wastes “indiscriminately on wetlands” of Perungudi. The dumping ground has no landfill or liner, and being adjacent to Pallikaranai, a rainwater harvesting area recharging groundwater as well as lakes in south of Chennai, was directly polluting the freshwater resources. The Board took exception to the fact that the Onyx had failed to demarcate the area allotted for dumping, and that the primitive mode of dumping threatened the wetlands. Onyx, however, maintained that the dumping area in the wetlands was used as per the contract with the Municipal Corporation.

In this second case, too, the problem seems to be the lack of an integrated approach to environmental management. The Chennai Municipal Corporation privatized the waste collection and disposal while the treatment of the collected waste was excluded. The piecemeal approach to waste management led to inefficient and costly consequences, and burdened Chennai with additional service requirements of soil and water remedial for the wetlands. This experience shows that a world’s leading waste management firm may not look beyond its contract clauses, and may engage in environmentally unfriendly practices if the local administrative body granting the contract is negligent of the sustainability principle.

(iii) Water for Manila: Early termination of contract

In 1997, Manila awarded the largest water supply privatization contract in the world for its east and west metro population. Two concessions were given to one for the west to Benpres Holdings Corporation and Lyonnaise des Eaux of Suez at 4.97 pesos/m³ (named Maynilad); and one for the east to Ayala, Bechtel, and North West at 2.32 pesos/m³. The performance of the privatization project has been mixed, with the east concession doing better than the west in terms of non-revenue water. The east concession reduced non

revenue water from 65% to 57%, while that of the west remained at 68% (McIntosh 2003: 90-91).

In December 2002, Maynilad terminated its contract with the Metropolitan Waterworks and Sewerage System, over a disagreement in tariff rates. According to Suez company press release, by the end of 2001, 150,000 new connections had been installed, extending service to 560,000 residents of low-income neighborhoods.³⁸ An independent survey reported only 75,000 new connections had been achieved, and five years after the privatization Manila still contained 5 million urban poor without access to piped water (McIntosh 2003: 91-92).

(iv) *Creating Model Cities in China: The positive externality of Olympics 2008*

The decision to host the 2008 Olympics in China has certainly had positive externality effects for environmental capacity building in selected cities. Some of these investments have been financed with loans from international agencies. For example, Beijing is building six wastewater treatment plants. The first plant is estimated to cost €40 million, financed through a World Bank loan to Beijing municipality, while Veolia Water and Hong Kong firm Kerry is providing another €5 million. Veolia Water (of Veolia Environnement, earlier Vivendi) expects cumulated revenue of €50 million in this 20-year contract. Veolia Environment reports regular growth in China since 1997 in other businesses as well, like Onyx's state-of-the-art waste to energy site built in Shanghai with a 20-year contract.

In 2002, Shanghai granted the first privatization project in water production and distribution to Vivendi. In 2001, Shanghai had 158 water supply companies, of which the 121 bigger companies were profitable. The non-profitable smaller companies were all located in townships that covered their investment costs with government grants. Pudong-Vivendi is the largest firm, where Vivendi has a 50% stake (McIntosh 2003: 156). The water service level in Shanghai is excellent, with 100% of the population being provided with piped water 24 hours of the day. The average leakage rate is only about 17%, and the government is also encouraging water utilities to fund investments with increased tariffs (ibid).

Not all privatization of water services in China have been successful. Over-estimation in demand for environmental services like water in one municipality has led to excess capacity and financial burden for the state department in charge of distributing the water to consumers. In the city of Chengdu in the Chinese province of Sichuan, water is provided by two suppliers: the Chengdu Municipal Water Supply Company and a joint venture of Generale des Eaux. The joint venture company Chengdu Generale des Eaux Marubeni Waterworks Co. Ltd, which is owned by a consortium of Vivendi (France) and Marubeni (Japan), was awarded a 18-year contract to build and operate a modern water supply plant, water intake works and a transmission line to improve water supply. The joint venture

³⁸ Suez press release dated 02/07/2003.

company started producing 400,000 m³ per day in 2002, while the municipal company produced 980,000m³ per day (Mc Intosh 2003: 140). Unfortunately, it turned out that demand had been overestimated, and the actual water requirement was only about 1 million m³ per day. The distribution company however was forced to buy 400,000 m³ per day from the private sector joint venture at the specified price under the contract. This experience has raised questions about the risks involved for governments signing ‘take or pay’ BOT contract as well as the adverse incentive that private providers may have to overestimate market demand in order to increase the value of the project.

(v) *Water privatization in a transitional economy: Vietnam*

Vietnam also began encouraging private participation in environmental services in the 1990s. In Ho Chi Minh City, three build-operate-transfer contracts were signed during 1995-99 for bulk supply of treated water. The state remained responsible for distributing to consumers and collecting tariff, and the private provider sold the water to the state department. Unfortunately, the production capacity exceeded the distribution capacity, leading to excess supply and consequently financial burden for the state department since the state needed to pay the firms under the contract, even in the presence of excess supply of water. Financial difficulties required the termination of one of the concessions (Mc Intosh 2003: 90).

The experience in Vietnam (as well as Chengdu in China) illustrates the problem when market demand estimation may be wrong and financial risks make the entire privatization process financially unsustainable for the government. In order to minimize the revenue risk for the private providers, governments commit to take on the entire onus of collecting tariff from the consumers and hence take on the entire financial risk, while the private firms get a fixed price.

Some Observations:

The policies to encourage privatization and liberalization of environmental services in Asian developing countries, as elsewhere, have been based on the tenet that private firms are more efficient both technically and economically. There is, however, no empirical evidence to that effect. A cost analysis of public and private water utilities in Asia³⁹ found no strong evidence of private providers being more efficient than public providers, and the authors indicated that “the inconclusiveness of the comparison of efficiency in public and

³⁹ Using cross-section sample data of 50 Asian firms in 19 different countries, including China-Hong Kong-Chinese Taipei (5 firms), India (4), Indonesia (3), Korea (2), Malaysia (3), Philippines (3), Thailand (3), Vietnam (2) among others. The survey data was sourced from the Asian Development Bank. Of the 50 utilities covered, 22 of them had some form of private sector participation. (Estache and Rossi 2002: 141, 143). Estache and Rossi estimated a cost frontier (since most water utilities try to minimize costs given the output and a preset tariff), and measured economic and technical efficiencies as a function of the error term in the cost function.

private water utilities may simply reflect the fact that competition matters more than ownership” (Estache and Rossi 2002: 147).

In water services, the problems of population coverage and high incidence of non-revenue water has persisted after private management took over water services in some Asian countries. *Non-revenue water* is one of the indices of efficiency in water provision services, and includes water lost in the distribution system, due to leakage or theft, for which the provider does not earn any revenue. In Manila, five years after the largest ever water privatization project in 1997, 5 million urban poor remain without piped water, and in Jakarta four years after privatization, there is about the same number of people without access to piped water (McIntosh 2003: page 92). Private sector management has failed to reduce non revenue water in Jakarta (about 50%), and illegal connections and meter reading seem to be continuing as under the public water utility system (probably due to the same staff continuing under the concession). In Manila, non-revenue water in 2001 was as high as 66% and 57% under the two concessions (ibid). This illustrates that change of ownership by itself has failed to increase efficiency in terms of revenue loss through theft or leaks. Moreover, with large sections of the poor population remaining without access to piped water the inequity in provision of essential infrastructure services has persisted with private management.

Asian countries have begun to realize that their existing domestic institutional frameworks are inadequate for the new forms of businesses emerging with liberalization in infrastructure facilities. For instance, there are no regulatory bodies to monitor the operations of water services, which until a decade ago were wholly in the realm of the public sector. In Malaysia the joint venture “*Indah Water Konsortium*” failed to provide the sewage services due to financial hardships. The Konsortium was renationalized, as were several other utilities. In 2004, the Ministry of Energy, Water and Communications asked the government to freeze water privatization until a regulatory board was established.⁴⁰ In Philippines, although the Manila Metropolitan Waterworks and Sewerage System had a Regulatory Office to monitor operations and adjust water tariffs, the Office was found to be technically inadequate, and this prompted efforts for its capacity building in 2001.⁴¹ The long term plan is to develop an independent regulatory body for similar privatized water utilities.

6. Environment Industries in Emerging Asia and the Role of SMEs

Among the Asian countries discussed in this paper, the environmental industries in Korea and Chinese Taipei are the most developed, followed by China, Malaysia and India. However, even the relatively more advanced environmental services segment in Korea and Chinese Taipei are dependent on imports of environmental technology from Japan, EU and

⁴⁰ Lovei and Gentry (2002: 73-77) and Castalia (2004: 92)

⁴¹ The ADB provided technical assistance of US\$0.66 million for regulatory capacity building in 2002. <http://www.adb.org/Documents/TACRs/PHI/tacr-phi-3703.pdf>

the US, since the domestic environmental industry still lags behind in technology in the world market.

The domestic environmental firms in Asia are typically medium to small sized. Even Japanese firms are considered more flexible and smaller than their counterparts in the US environment industry. Small environmental firms from developing countries like Malaysia have emerged in recent years as new players, and are now among the main investors in the energy and water markets of the region. This section gives a brief size description of the size and nature of the domestic environmental markets in China, India, Korea, Malaysia and Chinese Taipei.⁴²

The table at the end of the section classifies the nine countries by the nature of their trade and FDI policies and capacity of their domestic environmental industries.

(i) *China*

The environmental goods and services market in China was estimated to reach US\$17 billion in 2005 (140 billion RMB), having grown at about 15% through the last decade, and expected to exceed \$30 billion by the year 2010.⁴³ The industry has grown mainly in more developed areas along the coast and rivers of eastern China, consisting largely of medium and small enterprises and with only 6% being large firms (fixed assets worth more than 50 million Yuan, *ibid*). The Chinese industry has emerged as a competitive exporter in environmental equipment, and is now focuses on technology development. Environmental technology development and environmental project design and construction are the key domestic environmental services, accounting for almost three-quarters of the total revenue of the environmental services sector. Foreign environmental technology continues to be imported into the country, sometimes through projects financed by international agencies like the World Bank and Asian Development Bank, as in other Asian countries.

(ii) *India*

The current environmental goods and services market in India is estimated at \$5.29 billion, with half of this being imports.⁴⁴ Renewable energy is the largest sector \$3 billion; followed by water and wastewater treatment (\$1.24 billion), solid waste management (\$411 million), air pollution (\$408 million); environmental consulting (\$124 million) and hazardous waste management (\$102 million). Although the environmental consulting segment is small, it is expected to have the highest annual growth rate of 20%, energy and

⁴² The environmental market in Philippines is estimated to be US\$700 million, while in Vietnam it was estimated to be US\$ 480 million, with local production valued at \$290 million in 2004. Vietnam does not export any environmental equipment or services. (US Commercial Service website: <http://www.buyusa.gov>)

⁴³ The Yuan values are taken from the website, and an exchange of US\$1=8.3 RMB Yuan has been used. <http://202.107.54.180/beizhan/english/exhibition/environment.htm>.

⁴⁴ US Commercial Service (2005).

air pollution each are expected to grow at 15%, while solid waste treatment is estimated to grow at a rate of 10%. The U.S. and West European countries are the leading source of imports.

The domestic environmental services industry consists of two sets of firms: large engineering firms offering environmental services as part of their equipment or technology package for pollution treatment; and smaller firms specializing in environmental consulting services. The larger firms offer environmental services as an integrated package through large turn-key consulting projects involving equipment or technology for pollution treatment. Such comprehensive project design and management includes the provision of engineering, construction, equipment, and operation and maintenance of general utility facilities, such as water, pollution and waste management systems for industrial clients. These Indian firms are typically well developed and large in terms of staff and scale of operations.

Some of the big firms like Reva Enviro Systems (P) Ltd. export services to other Asian countries. Reva, providing both environmental equipment and services in industrial effluent treatment, sewage treatment for municipal and industrial township, water supply schemes, operation and maintenance of treatment plants, has won projects Indonesia (biomethanization plant), Vietnam (effluent treatment plant for sugar distillery) and Turkey (biogas generating effluent treatment plant).

(iii) *Korea*⁴⁵

The environmental industry in Korea began to develop earlier than in the other countries discussed in this paper. During the 1990s, it grew at an average annual rate of 15%, reaching a value of US\$7.1 billion by 1999. The domestic industry has grown by localizing foreign technology and products, and continues to depend on imports of advanced technology. The infrastructure construction segment is dominated by general construction engineering firms, many of which are subsidiaries of large companies like Hyundai, Samsung, LG, SK, Kolon, Hanhwa, and Doosan. The large domestic firms often have subcontracting arrangements with foreign firms for specialized services.

It is interesting to note that the practice of sub-contracting by large Korean firms has been a vehicle for advanced technology transfer as well as a path of market participation for foreign firms (since the latter are not prime contractors). The main source of environmental technology has been Japan, followed by the US.

In 2001, there were about 12,400 domestic environmental firms.

⁴⁵ US-AEP (2002).

(iv) Malaysia

The Malaysian environmental market is estimated at US \$800 million, with the services segment accounting for about two-thirds of the market by value, around \$530 million.⁴⁶ While large multinational environmental corporations have begun to retreat from the South East Asian countries after early termination or cancellation of contracts (including Veolia and Suez) Malaysian firms are emerging as new investors in water and waste treatment services segment.

Malaysian firms made an early start by winning Vietnam's the first water privatization contract. The Binh An Water Supply Project, a BOT project to build a water treatment facility in Ho Chi Minh City, was awarded to the Sadec Malaysian Consortium in 1996. The facility was completed and became operational in 1999.⁴⁷

Malaysian operations have expanded to China, where the firms YLI Holdings, Temasek Holdings, PBA Holdings, Ranhill Utilities and DKLS Industries won five contracts in water services (World Bank 2005a: 4).

(v) Chinese Taipei⁴⁸

In 2000, the domestic environmental technology market was valued at US\$3.6 billion, approximately 64% of which was for engineering design and equipment, 34% for services, and 2% for environmental equipment manufacturing.

There are more than 700 firms in Chinese Taipei supplying environmental technologies or services most of which are environmental service companies. The environmental service providers are concentrated in the segment of solid waste management, followed by water and waste water treatment. Most of the domestic firms are small or medium in size, with a staff size less than 20 and registered capital of less than NT\$ 30 million. The domestic environmental market has suffered due to the economic crisis in the late 1990s, the migration of Chinese Taipei companies to mainland China, as well as increasing competition from the Chinese environmental industry.

In 1996, Chinese Taipei began exporting environmental equipment with exports reaching \$20 million in 1997. Wastewater treatment equipment is exported to other Asian countries like China, Malaysia, Indonesia, Philippines, and Thailand. Chinese Taipei also imports environmental equipment and technology: Japanese firms dominate the import supplies, followed by German and US. Compared to other foreign firms, the Japanese companies

⁴⁶ US Trade Mission to East Asia 2006, http://www.ita.doc.gov/doctm/environmental_sea_0406.html

⁴⁷ <http://www.sadec.com/AboutUs/smc04.html>

⁴⁸ Based on information in *Chinese Taipei Environmental Industry Profile*, Environet, Ministry of Economic Affairs, <http://www.environet.org.tw/e-04envr05-01.asp>.

have been more successful in providing products and technology tailored to the needs of Chinese Taipei importers.

Significance of SMEs in environmental services

The global environmental services industry ranges from very large to very small enterprises, depending on the nature of the service in question. Environmental services that require large-scale investment due to economies of scale (and that support the emergence of natural monopolies) are typically provided by a small number of large firms. In sewerage services for instance, collection and distribution network investment is economical only for a single large operator. Considering the scale benefits due to large capital investments and technological development, there has been a tendency towards increasing concentration in the environmental industry. Moreover, municipalities have been seen to work with few large environmental service suppliers as monitoring and tracing liability is easier. In the global market large multinational corporations (e.g. Veolia Environnement, formerly Vivendi) dominate a few market segments in water and wastewater treatment. These larger multinationals provide integrated products and services required for environmental systems management. The large integrated multinationals account for about 50 percent of the total environment market and the other half is accounted by the smaller firms.⁴⁹ On the other hand, specialized environmental services, including analytical services and consulting, are widely provided by both medium-sized and small firms, who are often sub-contractors for large projects.

The domestic environmental service providers that have emerged in Asia are typically much smaller than the large multinational environmental service firms. The big firms are those that offer both environmental equipment and services, like Hyundai Engineering Co Ltd of Korea, which has a range of services from sewage treatment to water supply, and have also been exporting to countries including small countries in Asia and Middle East.

As seen in section 3.3 before, China, Korea, Malaysia and Chinese Taipei have made efforts to nurture the growth of the domestic environmental firms (medium and small by international standards) both in size and technological know-how, so that they might be able to compete in the global market (to begin with in the Asia-Pacific region) with the mature service providers from France, Germany, Japan, and US. In 2005, the provincial government of Rizal (Philippines) signed a memorandum of agreement with private organizations to help SMEs improve quality and productivity. New environmental firms like ESTI (Ecosystem Technologies Inc., established in 1995), offering technical services in solid waste management, water and wastewater treatment, signed the memorandum and expect to develop through the assistance in business linkages, equipment acquisition and funding.⁵⁰

⁴⁹ UNCTAD (1998): 8.

⁵⁰ Company website: <http://www.ecosystem-sbr.com/main.shtml>.

Asian environmental firms work together with the large multinational service providers in joint-ventures and also as sub-contractors for regional projects. For instance, in Vietnam WACO, the Water and Environment Joint Stock Company is a subcontractor of Hyundai-Mobis (Korea), which was awarded a water treatment construction project by the Thu Duc Water Corporation in 2005 that will supply water to Ho Chi Minh City.⁵¹ Sub-contracts as well as joint ventures help indigenous firms to upgrade operations and learn from larger and more experienced international firms.

Developing countries in Asia also have very small service providers in the water segment, a sector in which typically very large firms exist in the rest of the world. These small (and very small) enterprises - less than 50 employees, and often less than 10 - specialize in water delivery services (Kariuki and Schwartz 2005). Such small entrepreneurs are prevalent in countries where public utility services are poor, population coverage is low, and where there difficulties in accessing regions exist. These small-scale service providers typically distribute water through various ways, including neighbourhood piped systems, tankers and even water bearers. Even in cities where public water networks are well developed, absence of 24 hour piped water make the role of these indigenous entrepreneurs rather significant. These small-scale operators are also important for households which are not provided water connections by municipalities (in case of disputed or formal land right).

Among the countries discussed in this paper, such small and micro water delivery service firms are found in India, Indonesia, Philippines, Thailand and Vietnam. A recent survey found that the small water service operators are significant particularly in peri-urban, rural and remote regions, and seem to be the only viable providers for now (ibid). Thus the existence of these small operators has proved to be critical in providing the essential service of potable water to the poorer sections of population in Asia, which have been left out by the larger utility network. These enterprises can potentially become the local private operators in years to come.

Small-scale informal service providers are also common in solid waste management, especially in refuse segregation and recycling. Recycling services have been significant from informal micro operators including rag-pickers, and vendors buying paper, glass, and metal from households in the urban and peri-urban regions.

⁵¹ Waco is one of founding member of Thu Duc Water B.O.O Corporation for building Water Treatment. Company website: <http://www.wacocorp.com/english/index.php>.

Table 7. Summary of Trade-FDI Policies and Environmental Industry in Emerging Asia

<i>Trade, FDI Regime</i>	<i>Complementary government policies</i>	<i>Countries</i>
<p>Open since 1960s</p> <ul style="list-style-type: none"> Focus export-promotion of domestic environmental products and services; and import substitution. 	<ul style="list-style-type: none"> Early environmental regulations High government environmental expenditure Policies nurturing domestic environmental firms and development of more advanced environmental technology. 	<p><i>Korea, Chinese Taipei</i></p> <p>Relatively more mature environmental firms, exporting environmental equipment and services in other Asian countries.</p> <p>Continued dependence on import of environmental technology.</p>
<p>Open since 1980s</p> <p><i>Malaysia</i></p> <ul style="list-style-type: none"> Consistently open <p><i>Indonesia, Philippines, Thailand</i></p> <ul style="list-style-type: none"> Encouraged FDI in environmental infrastructure services in early 1990s, but more cautious since late 1990s 	<p><i>Malaysia</i></p> <ul style="list-style-type: none"> Environment integrated in economic plan in 1970s, with budget for environmental expenditure. 	<p><i>Malaysia</i></p> <p>Market size about US\$800 million (services segment \$530 million).</p> <p>Environmental services firms exporting to Vietnam and China</p>
<p>Open since 1990s</p> <p><i>(China)</i></p> <ul style="list-style-type: none"> Aggressively promoting FDI in environmental services since 1990s. <p><i>(India)</i></p> <ul style="list-style-type: none"> More gradual – relatively open to FDI in environmental services in 1990s; completely open since 2005. <p><i>(Vietnam)</i></p> <ul style="list-style-type: none"> Foreign investment more dependent on aid. 	<p><i>(China)</i></p> <ul style="list-style-type: none"> Aggressive targets for environmental protection Policies nurturing local environmental firms <p><i>(India)</i></p> <ul style="list-style-type: none"> No explicit promotional policy to nurture environmental service firms. 	<p><i>China</i></p> <p>Fast growing domestic industry, emerging exporter of environmental services</p> <p><i>India</i></p> <p>Moderately growing domestic industry, export in niche market of equipment and accompanying services.</p> <p><i>Vietnam</i></p> <p>Rudimentary environmental industry (market size about \$480 million in 2004)</p>

7. Concluding Remarks

The Asian developing countries are diverse in their stage of economic and institutional development, as well as in their natural environmental endowment. Consequently, the appropriate model for providing environmental services is unique to each country, depending upon its ecological characteristics, purchasing power of its consumers, type of environmental technology available, etc. For instance, in relatively water abundant countries like Indonesia, Malaysia, Philippines, the issue of competing water use may not arise, as it did in a relatively arid setting like Delhi. The environmental efficiency and sustainability question arose in the latter case, since under the BOT contract the state was obligated to provide raw water (and tried to do so at least cost) to Degremont.

At the same time, these countries have experienced similar challenges in the privatization of infrastructure services like water. The 1990s saw a surge in the foreign investment in water and sanitation projects, especially in the Southeast Asia and China. Under BOT contracts, the private provider sold the water to the state at a fixed price while the state company remained responsible for water distribution and collection of water tariffs from the consumers. Since water tariffs are low in the Asian developing countries, the state departments have found themselves in financial deficit as the tariff collection fall short of the payment made to the private provider. Some municipalities have also faced the problems of excess capacity due to overestimation of market demand (as in Chengdu in China and Ho Chi Minh City in Vietnam).

The essential problem in all these cases is that the governments have taken on the entire commercial risk of the investment in order to attract foreign technology investment in state-of-the-art water or waste treatment facilities. Since state departments in these countries are financially constrained to begin with, this has resulted in the early termination of contracts and the recent exodus of the large multinational environmental companies from Asian developing countries (except for China).

This suggests that the policies of privatization and liberalization in environmental services will not be successful in the ultimate goal of building capacity in essential environmental infrastructure in developing Asia by themselves. While there is an immense need for infrastructure services including water, sanitation and waste management, it will remain only *potential* market demand unless the need is supported by purchasing power. Since large sections of the population remain poor in countries like India, Indonesia, Philippines and Vietnam, the state would need to find better means of procurement. Their governments will need to depend more on tax revenue and committed budget allocations to provide essential environmental services, especially where low income levels do not make tariff hikes (say in water) a viable option.

Asian developing countries are also not well-equipped to regulate the new form of operations that have emerged with privatization of infrastructure environmental services. The provision of basic services like water and sanitation has to ensure equity, especially since large sections of the population remain poor in these countries. The experience in water services in Manila and sewerage services in Malaysia showed that *regulatory capacity-building* is required to monitor the functioning of these new enterprises.

The growth of environmental infrastructure and domestic service providers in Korea, Chinese Taipei, and now China has taken place along with the strategic government policies and increased environmental expenditure. Indeed, all three countries have also followed import-substitution policies along with liberalization to nurture the growth of their domestic environmental service providers. Through the 1990s, Korea has encouraged privatization and liberalization in environmental services with preferences built-in for domestic engineering firms. Domestic operators then subcontracted specialized services to foreign companies say for advanced technology. This served the twin purpose of boosting the growth of the indigenous environmental firms while upgrading the environmental technology used to build environmental infrastructure in the country at the same time. Having followed promotional policies to develop the domestic environmental enterprises for two decades, Korea revised its GATS commitment in 2005 by removing the market access barriers under Mode 3 for foreign commercial presence in sewage and refuse disposal services.

The lessons to be learned for the developing Asian countries are clear:

- *First*, environmental investment needs to be integrated into economic planning (as in Malaysia) and not pursued in a piece-meal way.
- *Second*, in the process of liberalizing environmental services, supporting economic and regulatory policies are critical to building environmental capacity. The environmental service markets in these countries remain high-risk, low-return business segments as is evident from the experience in South East Asia. Without economic stability the challenges for this sector will be amplified, especially since infrastructure environmental services entail huge sunk costs and investment returns accrue over an extended period of time. Also the new private-public enterprises need an independent regulatory board to monitor operations and prices.
- *Third*, developing Asia needs to recognize the environmental industry in its own right within the domestic economy and establish its industrial framework (like telecom and software services). Only then can promotional policies be adopted for service providers in this segment to nurture the supply capacity. Moreover, the distinct status of the environment industry would help the growth of small service providers, including the very small indigenous entrepreneurs who are today providing essential services like water to the population not served by public utilities.

The identification of the domestic environmental industry as a distinct economic sector is crucial for each country, since only then can the specific needs and strengths of the firms be better understood, and correspondingly the industry inputs taken for sector negotiations at the WTO. For example, since Korea and China recognized that technology was their major handicap, the liberalization policies encouraged technology import, but continued to promote the domestic industry in its equipment manufacturing and engineering capacities. This in turn allowed the government to offer clear commitments in the context of the GATS negotiations.

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APPENDIX - TABLES

Table A1. Income, Population and Urbanization in 9 Asian Countries, 2003

Country	PPP GNI per capita*	Avg. GDP growth rate [#]	Population (million)	Urbanization (% of pop.)	% pop below \$2**	Estd Pop. (million), 2015
China	4 980	9.6	1 288	39	46.7	1 390
India	2 880	5.9	1 064	28	79.9	1 232
Indonesia	3 210	3.5	215	44	52.4	247
Korea	18 000	5.5	48	84	<2	50
Malaysia	8 970	5.9	25	59	9.3	30
Philippines	4 640	3.5	82	61	47.5	98
Chinese Taipei###	23 400	3.2	23	-	-	24
Thailand	7 450	3.7	62	20	32.2	66
Vietnam	2 490	7.5	81	25	33.4	92

*Purchasing power parity gross national income (PPP GNI), for China the estimate is based on bilateral comparison with US, and that of India is based on regression. [#] Average annual growth rate of GDP for the period 1990-2003. **Poverty indices are expenditure based for these countries, except for Korea and Malaysia (income based), and cover various survey years: China- 2001 India- 1999-2000, Indonesia- 2002, Korea- 1998, Malaysia- 1997, Philippines, Thailand and Vietnam- 2000. ### Estimated data for Chinese Taipei for 2003, gives PPP GDP per capita, real GDP growth rate, population for 2015 is based on population growth rate of 0.4% p.a. (<http://www.actetsme.org/taip/taipecon.htm>)

Source: *World Development Indicators* (World Bank 2005).

Table A2. Foreign Direct Investment Flows in 9 Asian Countries (millions of US \$), 1985-2004

Country		1985-1995*	2001	2002	2003	2004
China	Inflow	11 715	46 878	52 743	53 505	60 630
	Outflow	1 687	6 885	2 518	- 152	1 805
India	Inflow	452	3 403	3 449	4 269	5 335
	Outflow	25	1 397	1 107	913	2 222
Indonesia	Inflow	1 364	- 2 978	145	- 597	1 023
	Outflow	532	125	182	15	107
Korea	Inflow	697	3 692	2 975	3 785	7 687
	Outflow	1 278	2 420	2 617	3 426	4 792
Malaysia	Inflow	2 924	554	3 203	2 473	4 624
	Outflow	676	267	1 905	1 369	2 061
Philippines	Inflow	727	899	1 792	347	469
	Outflow	86	- 160	59	197	412
Chinese Taipei	Inflow	1 009	4 109	1 445	453	1 898
	Outflow	2 671	5 480	4 886	5 682	7 145
Thailand:	Inflow	1 428	3 886	947	1 952	1 064
	Outflow	213	346	106	486	362
Vietnam	Inflow	633	1 300	1 200	1 450	1 610
	Outflow	-	-	-	-	-

*Annual average

Source: Data from *Country Fact Sheets*, UNCTAD World Investment Report (2005)

Table A3. Regional Distribution of Water and Sewerage Projects in Developing Countries, 2001-04

<i>Firm</i>	<i>Number of projects</i>	<i>Investm. (million US\$)*</i>	<i>East Asia & Pacific</i>	<i>Europe, Central Asia</i>	<i>Latin America, Caribb.</i>	<i>Middle East, N Africa</i>	<i>South Asia</i>	<i>Sub-Saharan Africa</i>
Suez Environement	17	1 053	9	2	1	2	0	3
Veolia Environement	16	1 088	8	6	0	0	0	2
New World Infrastr.	7	292	7	0	0	0	0	0
RWE Thames	6	762	3	1	2	0	0	0
Berlinwasser Intl	6	135	3	2	0	0	0	1
Total**	52	3 330	30	11	3	2	0	6

* Investment from all sources in projects in which sponsor has a stake of 15 percent or more.

**Data may not sum to totals due to projects involving more than one sponsor.

Source: Table 1 in World Bank (2005a)

Table A4. Openness of Selected Asian Countries, 2003

<i>Country</i>	<i>Trade in goods + services/GDP (%)</i>		<i>2004 FDI inflow/gross fixed capital formation (%)</i>	<i>Investment in public-private projects (mill \$), 1996-2003*</i>			
	<i>Exports</i>	<i>Imports</i>		<i>Telecom</i>	<i>Energy</i>	<i>Transport</i>	<i>Water-Sanitation</i>
<i>China</i>	34	32	8.2	13 325	16 203	16 769	2 436
<i>India</i>	15	16	3.4	16 997	9 714	2 300	216
<i>Indonesia</i>	31	26	1.9	10 481	7 535	2 315	919
<i>Korea</i>	38	36	3.8	-	-	-	-
<i>Malaysia</i>	114	93	19.1	3 591	4 210	9 605	1 106
<i>Philippines</i>	48	51	3.3	7 232	7 393	2 125	5 868
<i>Chinese Taipei</i>			3.1				
<i>Thailand</i>	66	59	2.5	5 086	8 214	591	348
<i>Vietnam</i>	60	68	11.3	295	2 628	115	213

Exports and imports of goods and services represent the value of all goods and market services provided to, or received from, the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude labor and property income and transfer payments.

*Investment in infrastructure projects with private participation refer to all investment (public and private) in projects in which a private company assumes operating risk during the operating period or assumes development and operating risk during the contract period. Foreign state-owned companies are considered private entities for the purposes of this measure.

Source: Tables 4.9 and 5.1 (World Bank 2005); FDI inflows in *Country Fact Sheets*, (UNCTAD 2005).

Table A 5. Forests and Pressure on Water Resources in 8 Asian Countries

<i>Country</i>	<i>Forest Area ('000 ha) and % share, 2005</i>				<i>Annual change in forest area, 2000-05</i>	<i>Fresh water withdrawal % total renewal water resource, 1998-2002</i>
	<i>Total</i>	<i>% land area</i>	<i>Primary</i>	<i>% forest area</i>		
China	197 290	21.2	11 632	5.9	2.2	22.28
India	67 701	22.8	-	0	0.6	34.05
Indonesia	88 495	48.8	48 702	55.0	- 2.0	2.92
Korea,	6 265	63.5	-	0	- 0.1	26.67
Malaysia	20 890	63.6	3 820	18.3	- 0.7	1.56
Philippines	7 162	24.0	829	11.6	- 2.1	5.95
Thailand	14 520	28.4	6 451	44.4	- 0.4	21.24
Vietnam	12 931	39.7	85	0.7		8.01

Source: *Forest Resources Assessment 2005* (FAO 2005) and Aquastat website (<http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm>) accessed January 2006.

Table A6. Participation of 8 Asian Countries in Major Multilateral Environmental Agreements with specific trade obligations

<i>MEA, year entered into force</i>	<i>China</i>	<i>India</i>	<i>Indonesia</i>	<i>Korea</i>	<i>Malaysia</i>	<i>Philippines</i>	<i>Thailand</i>	<i>Vietnam</i>
Convention on International Trade in Endangered Species, 1975	ac 1981	r 1976	ac 1978	ac 1993	ac 1977	r 1981	r 1983	ac1994
<i>Bonn Amendment, 1987</i>	at 1997	at 1980	at 1987	at 1993	-	-	-	at1994
<i>Gaborone Amendment</i>	at 1988	at 1989	-	at 2003	-	at 1988	-	-
Montreal Protocol on Substances that Deplete the Ozone Layer, 1989	ac 1991	ac 1992	r 1992	ac 1992	ac 1989	r 1991	r 1989	at1994
<i>London Amendment, 1992</i>	ac 1991	ac 1992	ac 1992	ac 1992	ac 1993	r 1993	r 1992	at1994
<i>Copenhagen Amendment, 1994</i>	ac 2003	ac 2003	ac 1998	at 1994	ac 1993	r 2001	r 1995	at1994
<i>Montreal Amendment, 1999</i>	-	ac 2003	-	at 1998	r 2001	-	r 2003	r 2004
<i>Beijing Amendment, 2002</i>	-	ac 2003	-	at 2004	r 2001	-	-	r 2004
Basel Convention on the Transboundary Movement of Hazardous Wastes, 1992	r 1991	r 1992	ac 1993	ac 1994	ac 1993	r 1993	r 1997	ac1994
<i>Ban Amendment</i>	r 2001	-	r 2005	-	r 2001	-	-	-
Cartagena Protocol on Biosafety, 2003	ap 2005	r 2003	r 2004	-	r 2003	-	ac 2005	r2004
Rotterdam Convention on Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, 2004	r 2005	at 2005	-	r 2003	at 2002	-	at 2002	-
Stockholm Convention on Persistent Organic Pollutants, 2004	r 2004	r2006	-	-	-	r 2004	r 2005	r2004

Source: Compiled from the following websites (last accessed February 6, 2005): CITES Secretariat (<http://www.cites.org/eng/disc/parties/index.shtml>); UNEP Ozone Secretariat (<http://www.unep.org/ozone/ratif.shtml>); Secretariat of Basel Convention (<http://www.basel.int/ratif/frsetmain.php>); Biosafety Protocol (<http://www.biodiv.org/biosafety/signinglist.aspx>); Rotterdam Convention on PIC (<http://www.pic.int/en/viewpage.asp>); Stockholm Convention (<http://www.pops.int/documents/signature/signstatus.htm>)

ac = accession; ap = approval; at = accepted; r = ratified. *Ratification*, *acceptance* and *approval* are legally equivalent actions but are only applicable in relation to the States that signed the MEA when it was opened for signature. *Acceptance* and *approval* are the actions taken by certain States when, at national level, constitutional law does not require a treaty to be "ratified". The term *accession* is used in relation to the States that did not sign the Convention initially.