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Urban Environmental Issues and Trends in Asia—An Overview

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This paper presents an overview of the linkages between population growth, urbanization, economic development, and environmental issues in Asian cities. Focusing on the areas of transport planning and air pollution, solid waste management, and water supply and sanitation, it looks at the major environmental issues faced by cities in the region, at the challenges confronting city adminstrators, and at some of the ways that they are responding. From the perspective of the environmental Kuznet's curve hypothesis, the authors argue that with appropriate policies, it should be possible for governments to continue to pursue economic growth while reducing environmental impacts.

Keywords: Air pollution, Asia, Environmental Kuznet's curve, Solid waste, Water, Wastewater.

1. Urbanization in Asia

In the year 2000, about 30 percent of the population in the Asia region lived in cities (World Bank 2003). Asia now has more major cities than any other region in the world. Table 1 shows the distribution of larger cities in Asia compared with the world total. China and India, the most highly populated countries, have the largest number of major cities.

There are, however, major disparities in the pace of urbanization within the region. Figure 1 shows the growth of urbanization in Asia from 1960–1999. As can be seen, urbanization proceeded rapidly first in Japan followed by South Korea during the 1960s; over 79 percent of the populations of both countries now live in urban areas. In Southeast Asia, urbanization started at a slower rate but gained momentum during the 1970s and 1980s. In Indonesia, for example, urbanization rate increased by an average of only 2.5 percent per annum between 1960 and 1970, but by 5.1 percent from 1970 to 1980, 7.5 percent from 1980 to 1990, and 10.3 percent from 1990 to 2000. South Asian countries have been experiencing only a gradual rise in their urban populations, but growth has been intensive in several major cities.

The speed of Asia's urbanization is without historical precedent. The urbanization of Europe in the nineteenth and twentieth centuries occurred much more slowly. Rapid urbanization in Asia has been

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synchronous with dramatic rates of economic growth as well as leading to severe environmental problems.

Urbanization has been closely linked with the growth of manufacturing industry. Japan's rapid industrialization started in the 1960s. Twenty years later, South Korea initiated a range of policies aimed at accelerating industrialization. China's Open Door policy was initiated in the late 1970s. It was followed by increasing economic openness and export-led growth models in Malaysia, the Philippines, Indonesia, India, and Thailand. Higher annual rates of economic growth were achieved and sustained by some of these countries.

Especially since the 1980s, the economic growth of Asian cities has been catalyzed by increases in foreign direct investment (FDI). This has been particularly pronounced in East and Southeast Asian countries (Singapore, Thailand, Indonesia, China, and Vietnam) but has also been evident in South Asia (India and Pakistan). The Asian currency crisis of 1997 produced only a short-term drop in FDI to most of these countries. Figure 2 shows the trends in FDI in the major Asian countries.

Table 1. Population in Asian urban agglomerations of over 3 and 5 million population, 1990

	More than 5 million		More than 3 million	
	Number of cities	Population (millions)	Number of cities	Population (millions)
China	4	36.11	8	50.91
India	4	37.27	7	49.17
Indonesia	1	9.42	2	12.42
Japan	2	31.01	2	31.01
Korea	1	11.33	2	16.08
Pakistan	1	7.67	2	11.75
Philippines	1	8.40	1	8.40
Thailand	1	7.16	1	7.16
Vietnam	–	–	1	3.17
Sub Total	15	148.37	27	190.08
Others	20	190.29	42	268.37
World Total	35	338.66	69	458.45

Source: World Bank 2003; UN-HABITAT 2001.

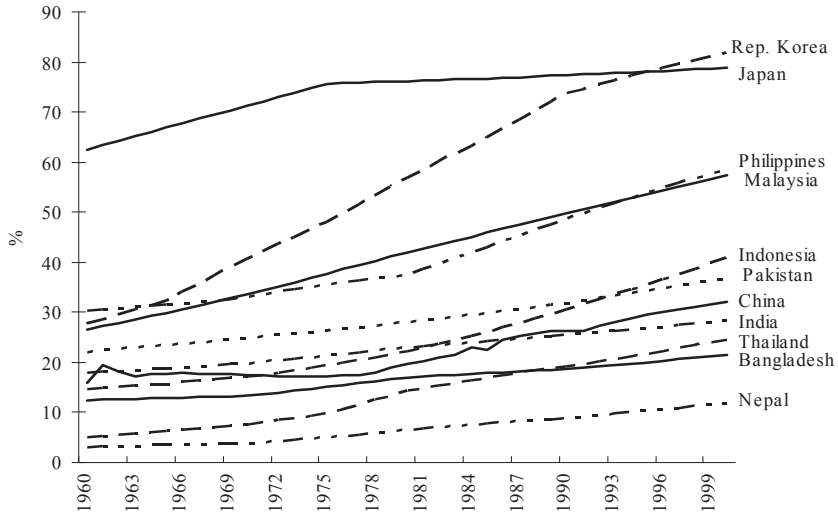

Figure 1. Urbanization trends in Asian countries (1960–2000)

Source: World Bank 2003b.

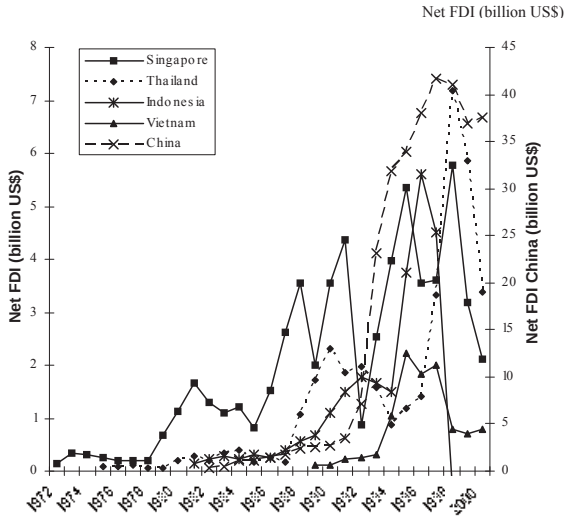

Figure 2a. Net Foreign direct investment in selected East and Southeast Asian Countries, 1970–2000

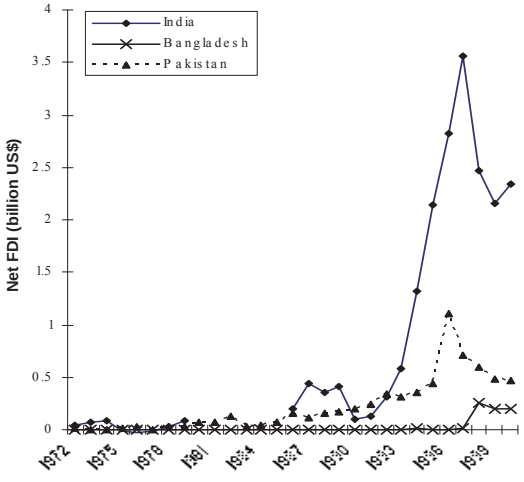

Figure 2b. Net Foreign direct investment in selected South Asian Countries, 1970–2000

Note: FDI = foreign direct investment
Source: Based on World Bank 2003.

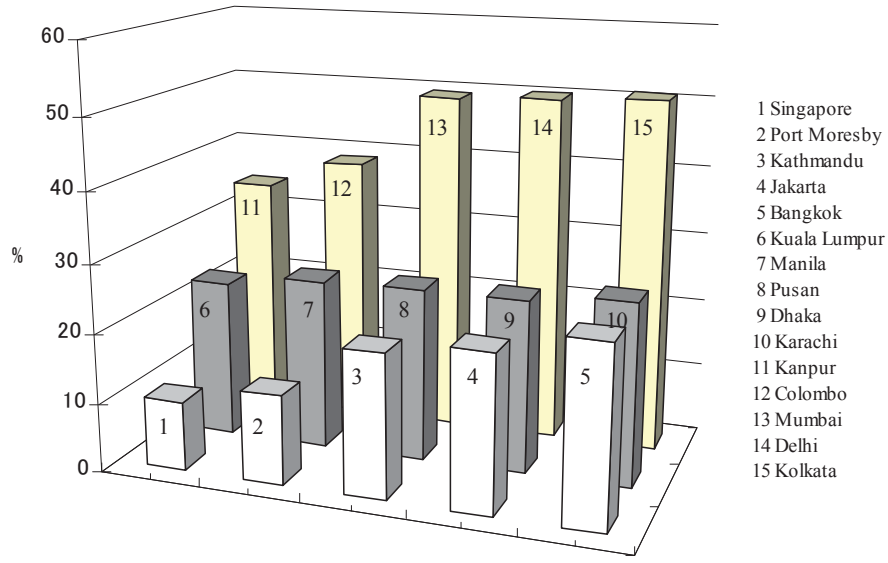

Figure 3. Share of slum population (illegal housing) in major Asian cities

Source: Ministry of the Environment, Japan, 1995.

According to Douglass (1995), Yeung and Lo (1996), and Tasaka (1998), these increases in FDI have created a new international division of labor in this region and are reconfiguring its cities with an entirely new structure that makes them functionally connected. These are described by Douglass as "Pacific-Asia urban corridors" and their interconnectedness is viewed as an additional driver of economic growth.

These rapid rates of urbanization and of economic growth have also led to pernicious levels of urban poverty in many Asian cities. Figure 3 presents the share of slum population in major Asian cities.

Yeung and Lo (1996) and Tasaka (1998) have shown hat the dynamics of urbanization in East Asia and Southeast Asia started to change rapidly in the 1980s. Tasaka characterizes urbanization in developing countries as "urban involution", referring to "various powers that were distortions of low development". Tasaka also uses three terms to describe the characteristics of urbanization in developing countries: "concentrated urbanization" (urbanization occurs while the rural population level is higher than that in developed countries); "primate cities" (over-concentration of economic, political and cultural functions in primary cities); and "over-urbanization" (inflow of population beyond a level the city can productively absorb). Among the factors associated with over-urbanization are high levels of unemployment and employment insecurity; large-scale inadequacies of infrastructure such as mass transportation systems, water supply and sewerage systems, and waste treatment facilities; environmental pollution; severe stress on urban governance; and overall poverty levels that hamper the formation of financial mechanisms that could facilitate urban environmental infrastructure improvements (Kidokoro 1998). Designing market-based financing tools for urban centers with substantial levels of urban poverty is a challenge for policymakers in Asian countries.

2. Environmental issues and underlying factors in Asian cities

With so many cities at different levels of economic development and social conditions, Asia is experiencing a wide diversity of urban environmental problems. In this section, we will look at three key urban environment issues: air quality management and urban transportation; solid waste management; and water supply and sanitation.

2.1. Air quality management and urban transportation

Three major sources of air pollution—industry, automobiles, and construction—are pillars of economic development. A study of the largest East Asian cities by Dhakal and Kaneko (2002) shows that the share of the tertiary sector in urban economies has been growing over the last two decades. At the same time, heavy industry has been moving out of residential areas and towards peri-urban areas. Thus the major source of urban air pollution is shifting from industrial pollution like oxides of sulfur (SOx), dust fall/total suspended particulate matter (TSP) to non-industrial pollution like oxides of nitrogen (NOx) and smaller particulate matter (PM_{10}/SPM).

With non-point sources dominating the emissions, SPM and PM_{10} have become the most important air pollutants in Asian cities. Figure 4 shows the annual average concentrations of air pollutants in 15 major Asian cities in 1999. PM_{10} concentrations in the ambient air of many cities of this region—among them Beijing, Kolkata, Chongqing, Jakarta, and New Delhi—exceed World Health Organisation (WHO) standards. In addition, NOx concentrations are higher than SOx concentrations in most of these cities, which clearly indicates the domination of non-point source pollution.

The urban transport sector is one of the major non-point sources of pollution and needs special attention in air quality management. $PM_{10,}$ $PM_{2.5,}$ and NOx are serious concerns and the transport sector is a major source of all three. Large numbers of vehicles, poor emissions-control standards, and low quality of available fuel are the primary factors adding to transport-related pollution in Asian cities. In some cities, the prevalence of three-wheelers with two-stroke engines has further aggravated the situation. In highly developed countries of the region like Japan, the problem of NOx pollution is very clear.

The solution to urban transportation problems lies, to a large extent, in good city and transportation planning. However, unlike cities in Europe, Asian cities lack proper city planning and the growth of urban centers has been haphazard. Transportation issues are addressed reactively, resulting in a lack of sustainable solutions.

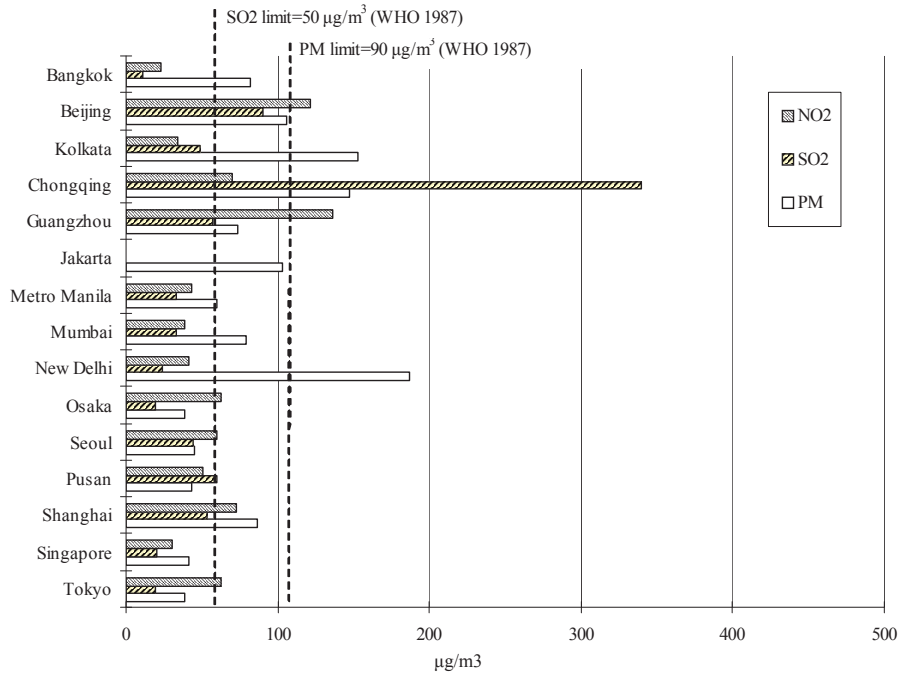

Figure 4. Annual average air pollution concentrations in Asian cities (1999)

Source: World Bank 2004.

Asia, with its prospects of continued rapid economic growth, is set to witness a parallel surge in urban transportation. Increasing inter-regional and intra-regional trade as a result of globalization have increased transportation activity (UN 2001) since the late 1990s. To date, several factors have hindered adequate provision of transportation services to match the increasing demand. These factors vary from country to country depending on economic growth levels. However, the major determinants are: population growth and urbanization, and investment gaps in infrastructure. The developing countries of the region show an infrastructure investment shortfall of perhaps 50 percent of the estimated total investment requirement in the transport sector. The huge capital costs and the time required to develop high-capacity mass-transit systems have prevented their timely implementation in rapidly growing urban areas (IGES 2003). With the recovery of the region's economies, the private sector and international financing agencies have a major role to play in making up the shortfall in infrastructure investment.

With the forces outlined above driving change, Asia is confronted with a variety of transportation problems and challenges (AIT 2002; IGIDR 2001; UN 2001). The following sections look at some of the major issues in urban transportation.

a. Growing motorization and congestion

There has been a considerable increase in motorization in almost all countries in this region (World Bank 2004). The number of vehicles in Bangkok grew more than sevenfold between 1970 and 1990, while in Beijing there was a threefold increase between 1991 and 2000. Similar trends are observable in

South Asia. In India since the mid-1990s, following the introduction of economic reforms that lowered costs and increased the affordability for private cars (Ramanathan 1999), Delhi's total motor vehicle population grew from 2.4 to 3.3 million (Iyer 2001; IGIDR 2001).

Two other indicators of increased motorization are vehicle density (measured in vehicles per kilometer of road) and cars per 1,000 persons. Rapid increases in numbers of cars combined with slow road development have resulted in increasing vehicle densities in nearly all countries of the region. The highest vehicle density can be found in Hong Kong, at 283 vehicles per road km, while at the lower end, India shows a ratio of only four vehicles per road km (World Bank 2003b). Brunei Darussalam and Japan have the highest rates of cars per 1,000 population, with about one private car for every two persons. India, China, Myanmar, Nepal, and Bangladesh have the lowest motorization, with rates of less than five private cars per 1,000 people. However, the vehicles in these countries are concentrated in a very few major cities, resulting in high levels of localized air pollution. The exponential growth of motorized two- and three-wheeled vehicles is another visible trend in Asian cities; they now account for over half of all motor vehicles, and the number is expected to grow very rapidly in China, Vietnam, India, and the other low-income countries (AIT 2002).

Such vehicle densities and poor infrastructure result in congestion, a common characteristic of motorization in most growing cities of the region. The centers of many capitals, including Bangkok, Delhi, Dhaka, Jakarta, Metro Manila, and Seoul, are particularly congested, with weekday peak-hour traffic speeds reportedly averaging 10 kilometers per hour or less. One estimate put the average travel time for work trips in Asia at 42 minutes, and as high as 90 minutes in some cities (UN-HABITAT 2001; World Bank 2004).

These high levels of congestion result in significant social losses. A study on Bangkok (UN-HABITAT 2001) estimated that the direct economic costs of congestion could be as high as 163 billion baht (around US$4.1 billion), annually. A World Bank study estimated that a 10 percent reduction in peak-hour trips in Bangkok would provide benefits of about US$400 million per year (cited in UN 2001).

b. Inadequate public transport services and increased burden on the state

Public transport is crucial to millions of poor and otherwise disadvantaged people in the region. However, inadequate and poor-quality services have exacerbated the growth of private modes of transport. In cities like Bangkok, Jakarta, Manila, and Mumbai the modal share of public transport varies between 40 and 60 percent of total person trips, which is far lower than in the developed cities of the region, Hong Kong, Singapore, and Tokyo, where the share is 70 percent (AIT 2002; UN 2001).

Public transport is capital intensive, and lack of sufficient investment and inappropriate pricing policies make it difficult to provide better service. Transport infrastructure development has remained chiefly the responsibility of the public sector, putting an enormous financial burden on national and urban governments. Inappropriate pricing policies not only burden the state but also result in significant impacts on real estate values, prices of essential commodities, and cost of living, and can influence the

dynamics of slum development in major cities. Private-sector investment has been very small even in megacities like Bangkok and Mumbai.

c. Other factors

Two other important issues hindering better transportation services are (1) low institutional capacity, and (2) lack of participation by stakeholders in the planning process. Local governments in most cities have serious capacity limitations in planning, development, and management of transport systems, resulting in delays in project implementation, wasteful investment, and other problems. Lack of appropriate institutional arrangements to form partnerships with the private sector is another major capacity limitation observable in the region. However, few Asian cities have any plans for, or have made any progress towards, developing their capacity and institutional arrangements. With only few exceptions, institutional mechanisms to ensure the participation of all social groups, including women and the poor, in the development of the transportation system are non-existent.

2.2. Solid waste management

High population growth and urbanization coupled with rapid economic growth greatly accelerate consumption rates in Asian developing cities. A concomitant to this consumption, municipal solid waste (MSW) generation is also accelerating; at the same time, the composition of the waste is changing. Figure 5 shows the relationship between per capita MSW generation and per capita gross domestic product (GDP) in Asian countries. In cities in Japan, South Korea, and Malaysia, the income level of residents has increased rapidly and the quantity and quality of waste generated is similar to that of western countries. In industrialized cities, more than 1 kilogram of solid waste is generated per person per day; in developing cities the corresponding figure is around half of that (IGES 2001). There is thus a significant difference in waste management challenges facing industrialized and developing cities in Asia. Table 2 presents the typical characteristics of waste management in Asian cities at different levels of development.

Table 2. Typical characteristics of MSW management in Asian cities

	Less-developed cities	Rapidly developing cities	Developed cities
GNI-PPP* per capita (2002)	Less than 2,000	2,000–15,000	16,000–30,000
MSW generation (kg/capita/day)	0.3–0.7	0.5–1.5	>1.0
MSW collection rate	<70%	80–95%	95–100%
Recycling	Informal	Formal and informal	Formal
expenditure from municipal budget (%)	15–40	5–25	1–5

* NGI-PPP: Gross national income in purchasing power parity.

Source: Mendes and Imura 2004b.

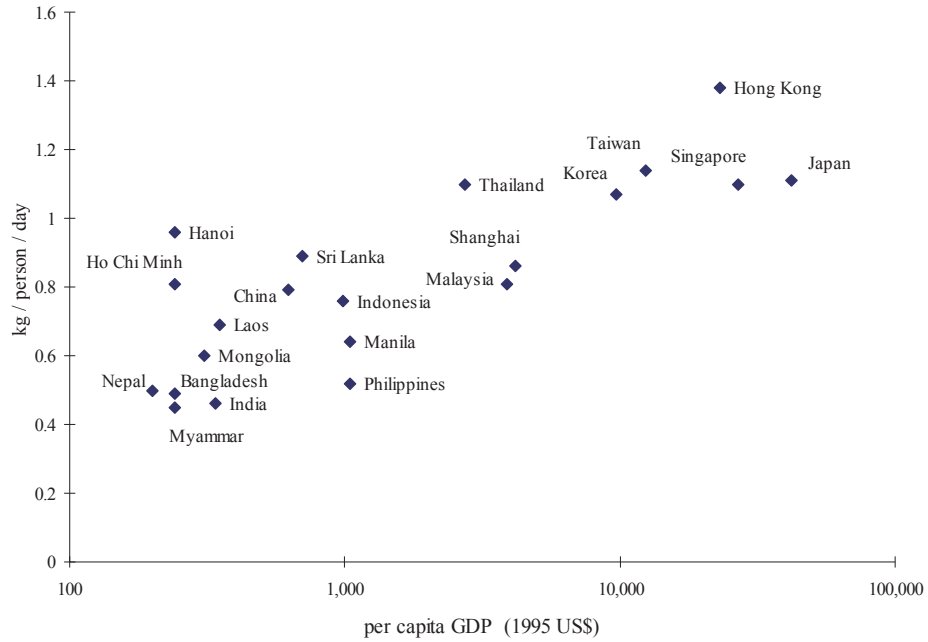

Figure 5. Relationship between MSW generation rates and per capita GDP in Asia

Source: World Bank 1999.

In developing cities, waste management systems tend to fail at the collection stage, and in all but a few isolated cases, proper means of disposal are missing. In developed countries, on the other hand, waste management tends to be efficient; the challenge is coping with a much larger volume of waste that is highly inorganic and recyclable, and the scarcity of land for waste disposal. Waste in these cities contains a great proportion of voluminous materials such as food containers and packaging materials (Mendes and Imura 2004a). Later on, we will discuss moves being made towards minimizing waste and more rational cycling of materials.

In poor cities, waste management is characterized by inefficient collection and unsanitary conditions. Waste treatment and disposal usually consist of open dumps, but some cities are adopting controlled dumps and partially engineered landfills. Composting and recycling are receiving more attention (Enayetullah and Sinha 1999). Due to its high costs, incineration usually is not practiced, except for hospital waste. Even in cities where high economic growth is being achieved, income disparities are often wide and growing. Poverty persists and leads to irregular settlements and people using scavenging as a very hazardous way of earning a living (IGES 2001).

Low systemic efficiency and lack of public participation further aggravates the already grave situation (Ogawa 1996; IGES 2001; Zurbrugg et al. 2002). To provide these basic civic services for the ever-increasing urban populations, financing is badly needed, and lack of private-sector participation and inability of the state to devote more resources has been the main cause of poor waste management in many Asian cities. These issues are examined in more depth below.

a. Lack of institutional capacity and regulation and poor systemic efficiency

Poor government policy and response, lack of political will, lack of appropriate economic and human resources, and weak institutions at the local level result in poor management of waste, especially in large but poor cities like Dhaka, Kathmandu, and Phnom Penh. Inefficient collection of waste (collection rates between 30 and 70 percent) and inadequate waste disposal cause serious environmental degradation and affect public health. Many cities are yet to institute waste-management regulations, so the sector operates without rules. However, national policies are now being formulated in several developing countries. Several national and local governments, in the Philippines, India, and Indonesia, for example, are developing policies towards proper waste management, but enforcement and monitoring remain deficient (United Nations Environment Program 1996).

b. Lack of financial mechanisms

Among less-developed and rapidly developing cities, lack of sufficient financial resources is a major constraint in waste management. This is true despite the fact that MSW management services account for a high percentage of municipal budgets in many cities of the region. In some Asian cities, MSW management costs can reach 40 percent of the total municipal operating budget, and of these costs, 70–90 percent is spent on collection. However, even this has proved to be insufficient to achieve the necessary level of services, and the absence of any sort of user fees and income-generation measures make waste management a virtually impossible task for the state.

c. Lack of private sector, community, and NGO participation

Although in Asia there are recycling activities promoted by communities, non-governmental organizations (NGOs), and the private sector, these activities, in general, are informal in nature and are not supported by the municipal authorities. Moreover, the level of private-sector participation is not sufficient to make a noticeable impact on overall waste management. Lack of institutional support limits the penetration of private-sector participation in solid waste management. Unclear regulations and division of roles between public sector and private sector restrict the formation of partnerships, which could play a crucial role (Chang, Ren, and Imura 2001). Although a few countries and cities, such as Malaysia, Singapore, Hong Kong, and Thailand, have started encouraging private-sector participation (World Bank 2003a), it is still long way from realizing its full potential.[1]

2.3. Water supply and sanitation

Many urban dwellers in Asia are still without access to adequate water supply and sanitation services. The WHO and the United Nations Fund for Children (UNICEF) have shown that although absolute numbers of people with access to water supply have increased due to rapid urbanization, in fact a smaller portion of the total urban population is now covered (World Health Organization and UNICEF 2000). Table 3 shows that many cities are still far behind the regional average coverage figures for urban

1. More information on different cases of private sector participation in the countries listed can be found on the Kitakyushu Initiative home page: http://www.iges.or.jp/kitakyushu. The Kitakyushu Initiative was adopted during the Third Ministerial Conference on Environmental and Development held in Kitakyushu, Japan, in 2000.

water supply. Because the supply of safe water is assigned a high priority, municipal water supplies are generally established before sewerage systems. As can be seen, in the Pacific coastal cities of Korea and China, coverage in 1997 was nearly 100 percent and water was available 24 hours a day. Some Southeast and South Asian cities, on the other hand, suffer from serious infrastructure inadequacies. For example, coverage in Jakarta was only 27 percent and water was available 18 hours a day. In Mumbai and Chennai (India), coverage was 100 percent and 97 percent[2] respectively, but water was available for only four or five hours a day.

In recognition of the severity of the problem, water and sanitation was given high priority in the United Nations Millennium Development Goals (MDGs), which include the goal of halving by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation. With efforts to realize this goal, it is expected that, in Asia, water supply connectivity will increase from the existing 93 percent to 96 percent, and basic sanitation from the existing 78 percent to 89 percent. Operational and management inefficiency is considered to be the major problem in water supply systems in Asian cities, and immediate action is necessary to improve the overall situation. Asian cities are experiencing major challenges in achieving these urban water supply and sanitation goals, in the form of lack of investment and poor governance. These two issues are examined below.

a. Lack of investment

According to the *Global Water Supply and Sanitation Assessment Report 2000* (World Health Organisation and UNICEF 2000), annual investment in urban water supply in Asia is about US$3 billion, comprising $2 billion from domestic investment and about $1 billion from external support. For sanitation, total investment is about $1 billion, where $900,000 is domestic investment. Looking at the share of total investment for water supply and sanitation in the total investment of the state, which is 3.6 percent in Asia compared to 5.3 percent in Africa and 8.3 percent in Latin America and the Caribbean, it would be very difficult to arrange massive additional investments from domestic sources to achieve higher water supply and sanitation targets, on top of the existing subsidies on water supply and sanitation services.

Most of the cities in this region suffer either from lack of infrastructure or from poor systemic efficiency in wastewater treatment. In China, only 16 percent of wastewater is treated (Song 1997). Though countries like India and Thailand enjoy a high percentage of their wastewater being treated (83 percent in Bangalore City, India and 70 percent in Chiang Mai City, Thailand), the performance efficiency of the treatment plants is very low. Other countries in this region suffer from serious lack of wastewater treatment; for example, Bandung in Indonesia has only 23 percent of its wastewater treated, Penang in Malaysia has only 20 percent treated, only 10 percent is treated in Karachi, Pakistan, while there is no record of wastewater treatment anywhere in Bangladesh (UN-HABITAT 2003). Wastewater, mostly domestic, entering water bodies without proper treatment makes water purification expensive, increasing water supply costs further. Massive external investment in water supply and sanitation infrastructure is required, alongside policies on wastewater disposal and control of water pollution.

2. It is possible that this figure does not include slum areas (Satterthwaite 2003).

b. Poor governance

Poor governance in the water supply and sanitation sector mainly stems from lack of policies on tariff schemes and on the roles of service regulators and service providers. Insufficient tariffs mean that public investment only subsidizes the existing levels of service rather than being used to improve coverage and quality. Low uniform tariffs also encourage wastage of water by the more affluent sectors of society, with the end result that the poorer sectors subsidize the rich (McIntosh 2003). Different departments and levels of government have taken on conflicting roles in many cities. Poor governance has also resulted in high levels of non-revenue water due to poor construction, operation, and maintenance of the infrastructure. Many of the urban poor are not yet served with piped water and do not have access to safe sanitation. As a result, they suffer more from water- and sanitation-related health risks. City administrators in developing cities are facing a rapid influx of poor migrants for whom employment tends to be temporary and insecure and who enter informal settlements.[3] Devising institutional

Table 3. Water supply coverage, availability, and consumption in major Asian cities, 1997

City	Coverage (%)	Water availability (hours/day)	Consumption (liter/capita/day)
Bandung	42	6	120
Bangkok	82	24	265
Beijing	100	24	96
Colombo	58	22	165
Delhi	86	4	209
Dhaka	42	17	95
Hanoi	76	18	45
Hong Kong	100	24	112
Jakarta	27	18	135
Karachi	70	4	157
Katmandu	81	6	91
Manila	67	17	202
Mumbai	100	5	178
Seoul	100	24	209
Shanghai	100	24	143
Singapore	100	24	183
Taipei	99	24	262

Source: McIntosh and Uniguez 1997.

3. The authors are grateful to the reviewers for their valuable inputs in improving this section in the revised version.

arrangements and allocating roles for different actors according to the changing needs, so as to cater for the needs of the poor while creating the right environment and incentives for the service providers, is a governance challenge faced by most cities in Asia.

3. Urban environment and economic growth: The environmental Kuznet's curve

It is accepted that environmental degradation is inevitable in a growing economy, but it has also been observed that the rate of this degradation does not continue to rise indefinitely. The environmental Kuznet's curve (EKC) hypothesis states that after continued economic growth and development, the incidence of environmental pollution levels off with GDP growth and then starts to fall. The "curve" takes the form of an inverted U. A variety of factors influence when the peak is reached and how far and quickly the pollution declines: economic growth; sources of pollution; policies and regulations; political and social characteristics; and institutional arrangements. Understanding these factors and the relationships between them will help in deriving sustainable solutions to the impending environmental problems in the region, even while rapid growth continues.

Economic growth alone cannot improve environmental quality (Stern, Common, and Barbier 1996). Environmental quality is influenced by many factors, both direct and indirect. Panayotou, in his study on 30 developed countries from 1982 to 1994 (Panayotou 1998), demonstrated that if the profile of economic growth remains the same, the level of pollution will be worse with greater GDP per square kilometer, higher share of industry in GDP, and faster pace of economic growth. With respect to the enforcement of contracts as a representative policy variable, Panayotou concluded that better-quality institutional arrangements not only made the turning point of the EKC occur earlier in economic development, but also tend to reduce the level of pollution. Environmental performance also depends on political rights and income inequalities (Torras and Boyce 1998). The level of environmental pollution is reported to be lower when political rights are stronger in a particular city. Torras and Boyce report that environmental quality (measured by sulfur dioxide and smoke) deteriorates as income disparities widen (as implied by an increased Gini Index)[4].

In addition to the factors above, technological innovation and individual preferences are major determinants that move an economy toward the EKC turning point (Lopez 1994, McConnell 1997). However, when the interests of different stakeholders cannot be easily reconciled, solutions to environmental problems will be delayed even if individual environmental awareness is high (Roca 2003). Hence, if institutional arrangements exist that enable reconciliation among the interests of stakeholders, it is possible to bring forward the EKC turning point. Shifting from industrial production toward tertiary industries in major cities would also help to reach the EKC turning point earlier. Such trends have been noticed in a few cities though in many of them it is still in the initial stages.

4. The Gini Index measures the extent to which the distribution of income (or consumption) among individuals or households within a country deviates from a perfectly equal distribution. A value of 0 represents perfect equality, a value of 100 perfect inequality

Thus, by establishing necessary institutions, stronger political rights, sound environmental policies and legislation, and multi-stakeholder partnerships, and moving industry outside urban centers, it should be possible to control pollution in Asian cities even as rapid economic growth and urbanization continue.[5] The following sections look at recent developments in urban environmental management.

4. Recent developments: Hints for solutions

National and metropolitan city governments in Asia have begun to recognize the need for urgent action to limit the environmental impacts of urbanization. In both developed and developing cities, a variety of responses are being tried, taking in both policy and action, to offset current trends and to move towards sustainable solutions. This section looks at some of these responses, focusing on the three areas looked at earlier: air quality management and urban transportation, solid waste management, and water supply and sanitation.

4.1. Air quality management and urban transportation

Several Asian cities have taken up or are considering measures to improve their urban transport systems and initiated measures to integrate urban transport in development planning. A few of these efforts are described below.

a. Improving public transport

With the increased awareness of the advantages of public transport, many cities in the regions have been actively considering ways to strengthen their public transport systems through improving existing services and introducing new services.

Recognizing the shortcomings of road-based transport systems to meet the growing demand for mobility, several larger cities in the region have developed, or are in the process of developing, rail-based transport systems. Bangkok; Busan, Incheon, and Seoul in the Republic of Korea; Kuala Lumpur; Manila; China's Beijing, Guangzhou, Shanghai, Shenzen, Daegu, and Tianjin; and Delhi, Kolkata, and Mumbai in India have all implemented new rail-based projects or are extending their existing networks. Almost all cities with existing rail-based systems are considering possible extensions to meet the growing demands (AIT 2002; IGIDR 2001; UN 2001; World Bank 2004).

Premium (air-conditioned) bus services are now available in a large number of cities in the region. Wealthier cities such as Bangkok, Kuala Lumpur, Shanghai, and Shenzhen, have introduced higher-quality buses on their roads. Some low-income cities also have introduced premium bus services, though on an experimental basis (IGIDR 2001; UN 2001). Cities with more advanced forms of transportation such as Singapore and Hong Kong have successfully integrated public transport services, such as subways and bus systems, provided by multiple operators (PADECO 2000). Delhi has been planning to introduce a metro network system fed by a bus network (IGIDR 2001).[6]

5. This observation is made based on the literature presented in this section. The authors do not intend to draw any conclusions or make policy recommendations on this point.

6. More information can be obtained from the Indira Gandhi Institute for Development Research, Mumbai, India or from the authors of this paper.

b. Switching to cleaner fuels

Present levels of air pollution have prompted many cities, among them Bangkok, Delhi, and Manila, to take measures to improve vehicle emissions. The most common measures include the introduction of lead-free gasoline and low-sulfur diesel; the introduction of vehicle emissions control standards and mandatory regular vehicle inspection systems; promotion of cleaner fuels, such as liquefied petroleum gas (LPG) and compressed natural gas (CNG) for commercial vehicles; banning and phasing out of certain types of vehicles; and restrictions on diesel vehicles and superannuated gasoline-powered vehicles.

Delhi has imposed a complete ban on diesel-powered buses and trucks and ordered the conversion of the entire bus fleet to CNG. Now, all public transport vehicles, including feeder services, run on CNG (Government of National Capital Territory of Delhi 2003). Several other major cities, including Dhaka, Kathmandu, and Mumbai, are following similar conversion programs (Yedla 2004). India has also successfully implemented a nationwide lead-free gasoline program. Similar efforts to control pollution from urban transport in different cities include: implementation of an air quality management project in Bangkok; Anti Smoke Belching Program in Manila; inspection and maintenance program for private cars in Jakarta; restricting entry of older vehicles into the city, and mandatory inspection and maintenance programs in Delhi and Mumbai; and phasing out of two-stroke engined three-wheelers in Dhaka (AIT 2002; IGIDR 2001; UN 2001; Yedla 2004). Unleaded gasoline is common in most cities in Asia; however, in a handful of developing cities, it is only slowly gaining momentum due to improper pricing.

c. Technology application

The application of intelligent transport systems (ITS) technology is an important next stage in transport-sector development for cities with relatively advanced transportation systems. The major application areas of ITS technology include electronic road pricing, traffic management, integrated ticketing systems for different public transport modes, and traveler information. Electronic toll collection (ETC) is in use in some countries with stronger economies: China, Malaysia, the Philippines, and Thailand. Hong Kong and Singapore have introduced more comprehensive electronic toll and parking fee management systems (UN 2001). The introduction of smart-card integrated ticketing systems for public transport systems is another significant development. The first such large-scale system was introduced in Hong Kong in 1997; the contactless[7] cards offer a common ticketing system for more than 30 transit operators providing bus, ferry, and rail services (Frost 2001).

d. Private-sector participation and partnerships

The increased participation of the private sector in providing urban transport infrastructure and services is an encouraging feature of transport development in many Asian cities. Major toll roads and rail transit systems have been developed in Bangkok, Kuala Lumpur, and Manila with private-sector

7. A contactless card is a chip card that can be used in applications such as public transport, where commuters do not have to physically insert or closely swipe a card in front of a reader. It offers multiple functions.

participation. The private sector is also assuming a greater role in providing public transport services. The number of standard (non-air-conditioned) buses operated by private companies in Bangkok increased during 1996–2001. The deregulation of bus fares has encouraged private operators in Dhaka to introduce a large number of buses (UN 2001). Partnerships among major actors—in the public and private sectors, national and foreign governments—in providing urban environmental infrastructure is on the rise and gaining momentum in Asian cities (Chang, Ren, and Imura 2001).

e. Participatory approaches to urban transport planning

Asia's rapid urbanization presents city planners and urban transport departments with urgent challenges. The conventional approach to environmental management, in which problems are handled on a top-down, sectoral basis, needs to be replaced by an integrated metropolitan-wide approach (IGES 2003), including to urban transportation. Involving the community in planning processes provides better scope for successful implementation of projects. Integrated approaches are based on methodologies that develop a broad-based consensus on an achievable vision of the future and clearly articulate the means by which these visions can be realized. As has been mentioned, reconciling the opinions of multiple stakeholders can help to reduce pollution without compromising economic development. These insights have been guiding the implementation of a pilot project in the Ko Rattanakosin area of Bangkok, which is being jointly implemented by the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) and the Bangkok Metropolitan Administration, working closely with the Government of the Netherlands (UN 2001).

f. Integration of local pollution control and greenhouse gas mitigation measures

The urban transport sector in Asia has contributed substantially to greenhouse gas (GHG) emissions. However, it is difficult to consider GHG mitigation in urban transportation planning due to the fact that developing cities in Asia are not under any obligation to control their GHG emissions. The priority for city policymakers is controlling localized pollution resulting from transportation. However, by integrating GHG-mitigation considerations with local pollution control measures, policymakers can find themselves in a "win-win" situation, able to access FDI and the Clean Development Mechanism funding to invest in capital-intensive urban transportation development. Some Asian cities already seem to be showing interest in integrating GHG mitigation and local pollution control within their urban transportation strategies, with substantial benefits in both areas (Yedla, Parikh, and Shrestha 2003).[8]

4.2. Solid waste management

As described earlier in this paper, developed and developing cities are facing different sets of issues in MSW management. The major new trends of MSW management in developing cities are improved community participation and private-sector involvement in service provision. Trends in developed cities are toward strategies to realize a "sound material-cycle society".

8. The IGES Urban Environmental Management Project Team, under its third phase research plan, will study developing strategies for the integration of GHG mitigation options into local pollution control measures in selected Asian cities.

a. Private-sector participation

As financing is one of the major constraints in MSW management, along with lack of efficiency, appropriate partnerships between the public and private sectors is potentially one of the most viable solutions, bringing in new resources and business know-how. Efforts are being made to introduce such partnerships in several Asian cities.

In East and Southeast Asian countries, the private-sector is playing an increasing role in construction and operation of MSW-disposal facilities under lease and concession contracts. MSW-related business in Malaysia, including construction and operation of waste collection and disposal facilities, has been transferred to several private companies under concession contracts. Similar contracts have been tendered to private companies for construction and operation of MSW-disposal facilities, such as landfill and incineration plants, in the Philippines, Thailand, Hong Kong, Macao, and Singapore. However, the requirements for advanced technology and emissions control in such projects tend to be stricter than for those operated by local governments (IGES 2001). For this reason, the role of the private sector is mainly limited to collection and transfer of waste.

Two more prominent examples illustrate how much the success of private-sector participation in MSW management waste depends on context. Since 1994, the Municipality of Phnom Penh has entrusted its waste-management services to private contractors with franchise agreements allowing them a monopoly. However, the service provider has changed six times, mainly due to financial constraints (Japan International Cooperation Agency 2003). Macao, with less than half a million population, has effectively involved the private sector in MSW collection and disposal. Since 1992, the collection and transportation of MSW and incineration have been contracted out to two private companies. This has improved both systemic and financial efficiency (UN 2003).

One more initiative getting a good deal of attention is in waste composting in Dhaka, Bangladesh. Waste Concern, a Dhaka NGO, started an initiative to promote community-based efforts for primary collection of waste, as well as to encourage composting to reduce final waste disposal quantities. By developing a partnership with a private fertilizer company, they have managed to successfully market their compost, which is a key to the success of any composting project (Zurbrugg et al. 2002).

Although most of the initiatives described here have been ultimately successful, they have faced many bottlenecks in their implementation. Moreover, such measures are situation specific and need to be devised on a case-by-case basis. For the most part, the public sector is likely to continue playing the dominant role in MSW management.

b. Promoting public awareness and participation

Increasing public participation at the collection stage is crucial to improve waste management. In Asia there is a general trend towards raising public awareness and increasing participation, though significant public participation is still far from a reality.

The government of Nonthaburi City on the outskirts of Bangkok launched a pilot project under the Kitakyushu Initiative,[9] to reduce final waste by increasing the level of recycling through public participation. Through active dialogue with the public; distribution of information materials to every household about recycling through source segregation; and providing plastic bags and bins for recyclable material to every household, a 20-percent reduction was achieved in waste needing disposal (UN 2003). Some similar efforts that have been documented include one by Waste Concern in Dhaka (Enayetullah and Sinha 1999), Stree Mukhthi Sanghatan, and Exnora in Mumbai, India (Yedla and Kansal 2003).[10]

c. Efforts towards achieving a sound material cycle society

In developed cities, the need has been felt for waste minimization and resource recovery in order to cope with the increasing volume and variety of waste, increased difficulty of processing, and shortage of landfill space. In several places, the "3 Rs"—reduce, reuse, and recycle—are being adopted (Mendes and Imura 2004a); better use of natural resources has been incorporated into national policy agendas with the intention of moving toward a "sound material-cycle society" or "cycling economy".

The sound material cycle is an extension of the traditional waste management line both backwards, including the stages before the resource became waste (that is, consumption, production, natural resource extraction); and forwards, through recycling. A sound material-cycle society is characterized by the cycling of resources, by a lower input of natural resources, smarter design of products, more efficient manufacturing, and more efficient consumption, as well as reuse, recycling, and proper treatment of materials that cannot be further utilized. Strategies towards a sound material-cycle society affect all stages of the life-cycle of a product, influence several industrial segments, and involve several actors, including governments, the private business sector, development organizations, media, public groups, and individual consumers (Ministry of Environment, Japan 2003).

Since the late 1990s, Japan, South Korea, Singapore, and Taiwan have been implementing policies for the promotion of recycling and more efficient use of resources. Japan enacted the Law for the Promotion of the Recycling Oriented Society in 2000 (Ministry of Environment, Japan 2003), renamed as Promotion of the Sound Material Cycle Society in 2003. In South Korea, the Act relating to Promotion of Resources Saving and Reutilization was revised in 1999 with stronger fines and regulations (Seoul Metropolitan Government 2000). Singapore and other developed regions in Asia are following the same trend by launching specific policies promoting waste minimization and recycling. China, as well, has developed an ambitious development plan with the objective of attaining an overall well-off (*sha kong*) society involving the concept of a circular economy by the year 2020 (Cleaner Production China 2004; China Council for International Cooperation on Environment and Development 2004). However, these visions are still a long way from the reality, and developed cities continue to be confronted with very high waste-generation rates.

9. See footnote 1.

10. Most of these efforts are local in nature and carried out by NGOs and community-based organizations. However, the role of the state in such efforts is not inconsiderable. More information on such "best practices" can be found at http://www.iges.or.jp/kitakyushu.

4.3. Water supply and sanitation

As described above, many cities are having problems providing adequate water supply and sanitation to fast-expanding city populations. Many people are without piped water and in numerous places, most if not all wastewater runs untreated into natural water courses. Governments are barely able to invest enough to maintain existing levels of service. Because developing water infrastructure is capital intensive, with very slow rates of return, it is unattractive to private-sector investors. In addition, the changing nature of the urban centers and the population to be served makes such projects even more complex and risky. At the same time, poor governance and operation of water infrastructure has led to inefficiency, which in turn hinders development. This section looks at some of the steps Asian cities have taken to overcome these constraints.

a. Financial mechanisms in providing environmental services

The gap between supply and demand for urban environmental infrastructure and services is widening with rapid urbanization and economic growth. The existing government budget allocations could be used more efficiently, but the need for new financing mechanisms is unavoidable. User charges could be an important source of extra finance. However, at present, user charges tend to be quite low in relation to cost-recovery targets; in many countries, user charges are too low even to meet operation costs. In Japan, revenue from user charges covers only about 40 percent of the operation and maintenance costs of the sewerage system (Imura, Morishima, and Inui 2005). Because of the current levels of user charges and the perception of water supply and sanitation as essential public services, increased public awareness and political will be essential elements for successful introduction of higher user charges (Memon 2004). Panayotou (1998) outlines a number of other possible financing sources, including property rights, market creation, fiscal instruments, charging systems, financial instruments, liability systems, performance bonds, and deposit-refund systems, that can be used for water and sanitation infrastructure as well as a range of other environmental applications.

Environmental funds and investment bonds are becoming popular in some of Asian countries (European Bank for Reconstruction and Development 1999; United States Environmental Protection Agency 1999). Environmental funds are created at either national level or at local level with national support. They provide financial assistance to improve environmental infrastructure and services at low interest rates and easy terms. Environmental funds can take several forms. China, for example, is trying to replicate the United States' experiences of using revolving funds to support wastewater infrastructure. One important factor in environmental funds is that the regulator and monitor should be independent of the service provider. One way to do this is to have a multi-stakeholder board to monitor transparency. Microfinance models like the Orangi Pilot Project[11] and Bangladesh's Grameen Bank may provide good guidelines for management of these funds.

Investment bonds are commonly used in many developed countries. The World Bank has developed a useful list of pre-conditions (Daher 1997) for successful issuance of municipal bonds, including, among

11. More information on these projects can be obtained from the Kitakyushu Initiative website. See footnote 1.

others: well-developed capital markets, a history of macro-economic stability, availability of sound local government institutions, and predictable fiscal relations with central government. Few developing countries can yet meet all of these pre-conditions. However, India and Indonesia are taking the lead in trying municipal bonds (Phelps 1997; Daher 1997; Varma 1999). Many Asian countries, especially in East Asia, are moving toward strong capital markets and regulation; thus, they should be able to introduce municipal bonds much earlier than other countries in the region. Local governments are gaining more independence through decentralization processes in many countries, and this is likely to see them generating resources for local development and services through a variety financial mechanisms, including municipal bonds.

Among other possible financial instruments, emissions taxes are currently being used in China and Thailand, while effluent charges are in place in China and the Philippines (Anderson 2002). Market creation through emissions trading, tradable permits, quotas, and shares is also a popular concept, especially to address industrial wastewater and air pollution. This helps to generate finances for wastewater treatment infrastructure. Though no one has yet put this idea into practice, groundwork is being done, especially in China, to introduce it.

Allocating clearly defined roles is the key for partnerships, and many Asian countries do not have sufficient institutional support to implement active private-sector participation in environmental services. Communities and consumers are not taken into confidence while devising the agreements. According to Kwak (2000), such efforts, including information dissemination and public hearings, would help to reduce various risks involved in partnerships. Improving much-needed private partnerships in providing environmental services is a bigger challenge to Asian cities facing high inflows of poor migrants.

b. Changing roles: Civil society, private sector, governments, and international cooperation

According to the World Bank (2000) an integration of availability of infrastructure, financial mechanisms, institutional set up, and stakeholder participation is vital to improve the environment and sustain it over the time, without compromising economic development. To develop effective urban environmental governance, it is very important to identify the roles of the various actors. Governments, changing from their role of service providers, have to formulate regulations and set up impartial regulatory bodies and monitoring systems. Restructuring and strengthening of the institutions is needed to support such partnerships. Governments have to confront equity and efficiency issues and take the initiative to create enabling environments for community and private-sector participation in delivering urban environmental services.

There are many potential benefits if the private sector, be it international, local, or community groups, can be persuaded to play a bigger role in environmental infrastructure and services. It should bring in investment to increase the coverage of the services. It should also introduce technological innovation, leading to lower production costs and improved quality of drinking water and/or treated wastewater for discharge. Private-sector participation is also expected to control losses and improve efficiency. When the international private sector brings in new technology, it should capitalize on local knowledge and foster local expertise.

Civil society organizations, including research groups and academia, have an important role to play in supporting systemic assessment capacity of cities. They can also usefully carry out awareness-raising campaigns to have a significant impact on citizens' willingness to pay for services and in changing consumers' lifestyles to support environmental conservation. These groups can also play a vital advocacy role, raising important environmental issues to be considered by governments and the private sector.

International cooperation will remain crucial to developing urban environmental governance in developing countries. This role is being strengthened further in the wake of the rethinking of international cooperation models, away from purely donor-driven approaches using foreign expertise and focusing on physical projects rather than capacity building (Berg and United Nations Development Program 1993; Cassen and Associates 1985; Fukuda-Parr, Lopes, Malik 2002; Koppel and Orr 1993; Matsuoka 1996; Organisation for Economic Co-operation and Development 1991, 1992, 1995; Rix 1990; United Nations Development Program 2001). Inter-city cooperation has immense potential to contribute to environment, and most of this inter-city cooperation is aimed at strengthening local capacity, as evident from the activities of Kitakyushu Initiative (www.iges.or.jp/kitakyushu).[12]

5. Conclusions

Changes in the urbanization processes that have been observed since the late 1980s may accelerate the pace of urban economic growth, but they also aggravate environmental pollution. The growing gap between demand and supply of urban environmental infrastructure and services is very significant in Asia. With further rapid economic growth and urban clustering expected, the environmental situation can only worsen unless countermeasures are adopted in time.

Research to date on the relationship between economic growth and environmental problems shows that factors such as institutional arrangements, stronger political rights, environmental policies and legislation, technology adoption, multi-stakeholder partnerships, and narrowing social inequalities can have a larger impact on environmental improvement than urban infrastructure itself. In other words, it is not just "hardware" that determines the extent of urban environmental problems, but more importantly, the maturity of the "software", including economic and governing capacity. Maintaining a balance between efforts to improve infrastructure and to create good governance is an immediate challenge for city administrators and policymakers in Asia.

As has been seen, cities in Asia are starting to take the initiative to improve environmental quality. Alongside the more sector-specific changes, there are some more general trends: promoting public awareness and participation in environmental planning and provision of environmental services; moving of heavy manufacturing industry out of cities; encouraging private-sector participation in civic and environmental services to increase investment and efficiency; multi-stakeholder partnerships; introduction of innovative finance mechanisms; improving environmental governance and

12. This issue of *IRES* features another paper, "Inter-city Environmental Cooperation: The Case of the Kitakyushu Initiative for a Clean Environment", by Mushtaq Ahmed Memon, Christine Pearson, and Hidefumi Imura, which looks in more depth at this kind of inter-city cooperation in Asia.

environmental management capacity at different levels; and South-South cooperation for better exchange of information and cooperation. Although these trends are often only in the initial stages of testing and are sometimes facing implementation bottlenecks, there is evidence to show that Asian cities are learning from one another, with increasing frequency. Continuous and persistent efforts in these directions are essential to achieve better environmental management and services.

According to the literature on the EKC, these are the kinds of trends that should be able induce an earlier peak, allowing economic development to continue and at the same time reducing the environmental cost. As already observed, the development of Asia's cities is unpredictable and diverse. The fate of environmental quality and services in Asia will depend on sound judgment and realistic measures. Probably the key challenges currently facing Asian cities are to find how best to devise and execute multi-stakeholder partnerships with appropriate role and risk sharing; and how to find the ideal balance between provision of public goods and user charges in light of the ever-increasing populations of urban poor with high levels of insecurity in their lives. Urban environmental management strategies in this region need to be focused not just on improving basic services but also on ways to make those services reach the urban poor.

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