Public Participation for Urban Environmental Management: Overview and Analysis

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1. Urbanisation and environmental challenges

The rapid urbanisation and its implications in Asia and the Pacific region are very much visible, even without the analysis of the statistics. Urbanisation is a continuous phenomenon in most countries, especially in developing countries, where people opt to live in cities to seek more economic opportunities as well as to obtain better health and education facilities. Access to basic needs like water and sanitation, food, and housing is comparatively easy in the urban areas of most developing countries.

However, this access rate to basic facilities is decreasing at an alarmingly rate, as the demand for natural resources, including land, water, and air supersedes the rate of regeneration. Furthermore, pollution from urban activities is endangering the regeneration of these natural resources. This chapter highlights urban environmental challenges. The physical environmental challenges cover issues related with water scarcity and water pollution, waste generation, and air pollution. The environmental management capacity challenges cover issues concerning urban planning and infrastructure, regulations, institutions, financial mechanisms, appropriate technology, and stakeholder participation.

The combination of both types of challenges, physical and capacity, is vital to obtain the holistic picture for managing particular issues or overall urban environment. The rate of waste generation and lack of capacity to dispose off that waste properly creates challenges for solid waste management. Water pollution and lack of water supply and wastewater services lead towards the challenges in urban water management. The rate of air pollution from various sources and lack of capacity to effectively control the pollution makes air quality management a critical challenge.

The current rate of urbanisation also varies across the sub-regions. Southeast Asia is leading at 3.5 percent while South Asia and Northeast Asia are just behind at 3 percent and 2.7 percent respectively. In contrast, central Asia, which is not highly developed and not highly urbanised, is well below one percent. There are two major causes for this urbanisation. In South Asia and the Pacific, the natural increase is mainly due to population growth; in Southeast and Northeast Asia, economic migration is comparatively the largest cause.

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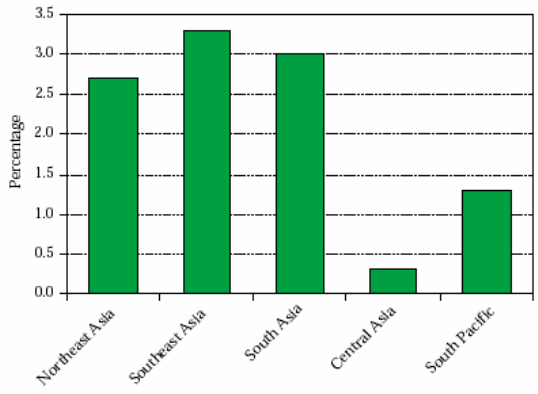
Box 1 Trends of urbanisation in Asia and the Pacific region

Degree of Urbanisation in 1999

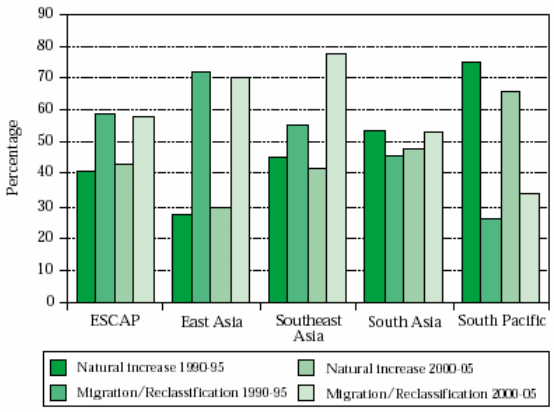
Less than 25%	8	Afghanistan (22), Bangladesh (21), Bhutan (7), Nepal (11), Sri Lanka (23), Cambodia (23), Lao People's Democratic Republic (23), Viet Nam (20)
25-50%	11	People's Republic of China (34), India (28), Kyrgyzstan (40), Maldives (28), Thailand (34), Pakistan (33), Tajikistan (33), Turkmenistan (45), Uzbekistan (42), Indonesia (39), Myanmar (27)
50-75%	9	Democratic People's Republic of Korea (63), Mongolia (63), Islamic Republic of Iran (64), Kazakhstan (55), Malaysia (57), Philippines (58), Armenia (70), Azerbaijan (57), Turkey (74),
75% and above	8	Hong Kong, China (96), Japan (79), Republic of Korea (85), Brunei Darussalam (72), Singapore (100), Australia (85), New Zealand (87), Russian Federation (77)

Rate of Urbanisation (1995-2030)



Source: United Nations 1996 and ESCAP 1999

Causes of Urban Growth (1990-2005)



Source: United Nations 1996 and ESCAP 1999

This rapid urban growth does not have only large so-called "ecological footprints;" urban activities are also causing major pollution through increased generation of wastes, water pollutants, and air pollutants. Pollution levels are alarmingly high, and their immense local, as well as global impact in terms of health, economy, and natural resources, is worsening. Box 2 shows the overall picture of urban environmental challenges in waste, water, and air. However, we are limiting our discussions in this report to waste and water only, inline with the scope of this thematic seminar.

In Asia and the Pacific region, solid waste generation is rapidly increasing due to population growth rates, improved living standards, and industrial activities. Out of the four major categories of wastes, municipal solid waste (MSW), industrial waste, hazardous waste, and agricultural waste, three categories are mainly concentrated in the urban areas of the region. MSW vary in volume, as well as in composition, from city to city, mainly in accordance with the number of people and their living standards. However, the volume of MSW is rising quite sharply, as the population in cities is increasing at a faster rate than national average and economic growth is also comparatively higher than the national standard. The World Bank (1999) predicts that the current MSW of 1.5 million metric tons daily from this region will be more than double by 2025. The composition of the waste will also change from organic waste to non-organic and hazardous or clinical waste. However, solid waste generation, which is much lower than developed countries, creates more environmental problems in this region, as many cities are not able to manage it due to institutional, regulatory, financial, technical, and public participation shortcomings.

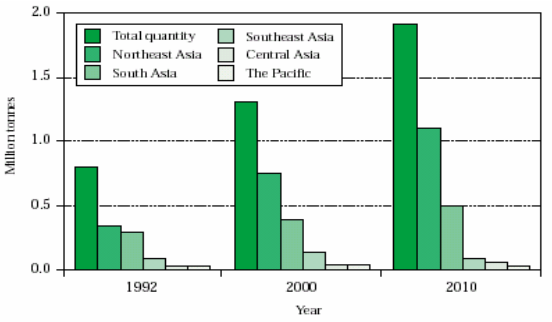
Industrial waste is about 1900 million metric tons per annum and is rapidly increasing as industrial

activities are picking up the pace in most of the countries in the Asia and Pacific region. The ratio of industrial waste to MSW varies from one country to another or from one city to another; however, it is consistent with economic growth rates, as it is 1:8 in Australia and Japan, while it is about 1:3 in China and much lower in Bangladesh and Pakistan. Nevertheless, industrial waste poses more environmental problems as it contains hazardous or organic chemicals.

These threats are worst in these cities, which are not yet prepared to take care of current waste generation rates. Most of the cities even fail to collect all the solid waste being generated.

Box 2 Urban environmental challenges in Asia and the Pacific region

a. Waste generation and disposal

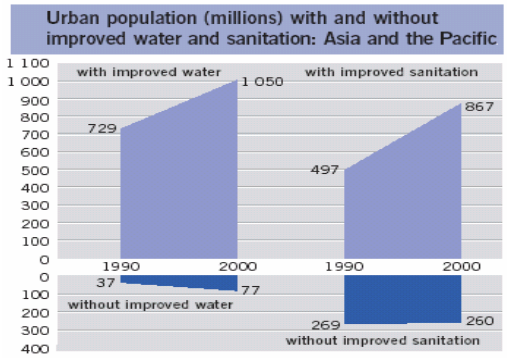


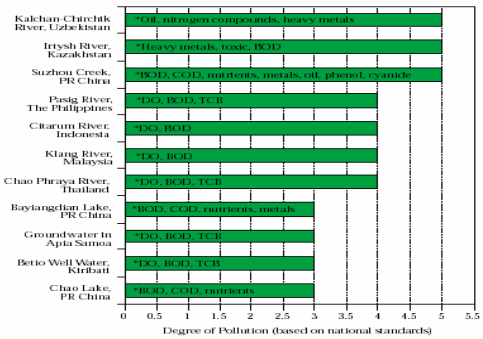
Source: United Nations 1995, World Bank 1995 and 1998, UNEP/SPREP 1997

Country/ Territory	Disposal methods				
	Composting (per cent)	Open dumping (per cent)	Land filling (per cent)	Incineration (per cent)	Others* (per cent)
Australia	10	–	80	5	5
Bangladesh	–	95	–	–	5
PR China	10	50	30	2	8
Cook Islands	–	60	30	–	10
Fiji	–	90	–	–	10
Hong Kong, China	–	20	60	5	15
India	10	60	15	5	10
Indonesia	15	60	10	2	13
Japan	10	–	15	75	–
Kazakhstan	–	85	–	–	15
Rep. of Korea	5	20	60	5	10
Maldives	–	90	–	–	10
Malaysia	10	50	30	5	5
Mongolia	5	85	–	–	10
Myanmar	5	80	10	–	5
Nepal	5	70	10	–	15
New Zealand	5	–	85	–	10
Pakistan	5	80	5	–	10
Philippines	10	75	10	–	5
Papua New Guinea	–	80	–	5	15
Samoa	–	80	–	–	20
Singapore	–	–	30	70	–
Sri Lanka	5	85	–	–	10
Thailand	10	65	5	5	15
Viet Nam	10	70	–	–	20

Source: ENV 1997

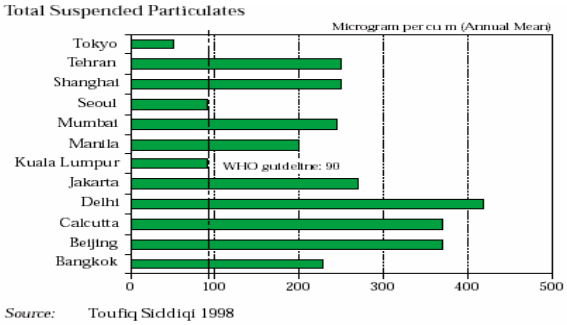
b. Water supply & sanitation and water pollution



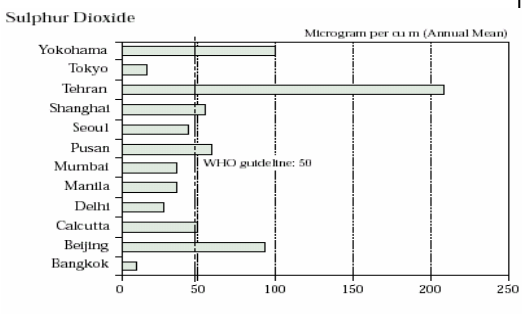


Source: ADB 1998

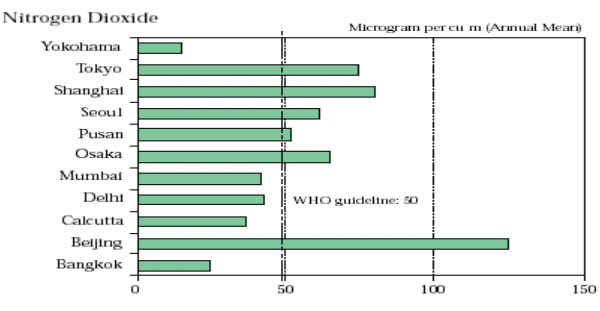
c. Air pollution



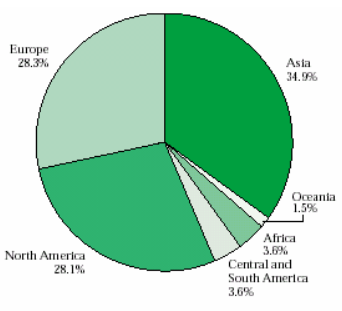
Source: Toufiq Siddiqi 1998



Source: Toufiq Siddiqi 1998



Source: Toufiq Siddiqi 1998



Source: Siddiqi 1999

The statistics from individual cities have been collected from their presentations made during the first thematic seminar on solid waste management under the Kitakyushu Initiative for a Clean Environment (*Annex I*). The following comparative scenario has been developed on the situation of solid waste generation and management in various cities of Asia and the Pacific.

Table 1 Comparative analysis of solid waste in cities of Asia and the Pacific region

	Group A	**Group B**	**Group C**
City	Dhaka, Kathmandu, Ulaanbaatar, Bhopal, Yangon	Cebu, Nonthaburi, Chongqing, Surabaya	Fukuoka, Kitakyushu, Macao
GDP (USD)	1000 to 3000	3000 to 10000	Over 10000
Waste generation (kg/person · day)	0.3 to 0.6	0.7 to 1.1	1.4 to 1.5
Collection rate (%)	Less than 70	80-90	Approximately 100
Treatment fees (USD/Person · Year)	Less than 1	1-3	38-220
Rate of expenditure in total budget (%)	15.4 to 38	6 to 23.2	1.6 to 5
Recycling	Informal (Metal, glass, plastic, composting)	Formal + Informal (Metal, grass, plastic, composting)	Formal (Metal, grass, plastic, furniture, clothing)
Incineration treatment rate (implementing cities / total cities)	0 / 5	1 / 4	3 / 3

From Table 1, it is evident that waste generation rates accelerate with economic growth; however, solid waste management also becomes effective with economic growth as seen from collection rates and final disposal.

Sewage and industrial effluent discharges, combined with storm water run-off from the roads, pollute the surface and ground water sources. World Bank data (2002) shows that about 75% of the urban population is connected with improved sanitation. The rest of the population is directly discharging wastewater into nearby surfaces or ground water sources. Furthermore, most of the household effluent from the improved sanitation is discharged without being treated at the required levels. Industrial effluents are the worst pollutants, as they also contain toxic and hazardous chemicals. In most of the cities, regulatory standards are not being effectively enforced, resulting in severe water pollution levels. The storm water run-off from roads also brings asphalt, lead, and petroleum particles.

Despite increasing coverage of water supply and sanitation, a large portion of the urban population is still without access to clean water and safe sanitation (Box 2). The existing serious challenges are maintaining quality and reliability of water supply and sanitation, as most of these services are being heavily subsidised. Higher government budget deficits are making it very difficult to fulfil this basic need of the increasing urban populations.

Urban water management could be analysed from two aspects. One is coverage and the other is efficiency. Most of the statistics suggests that urban water coverage is increasing; however, they fail to recognise whether water and wastewater cover is adequate (Hardoy et al. 2001). Efficiency covers issues such as cost of production, losses or unaccounted for water, staff per one thousand connections, cost recovery, operating ratio and so on. Table 2 shows the statistics for 50 urban water utilities (ADB 1997).

Table 2 Various indicators for water utilities in Asia

	Almaty	Apia	Bandung	Bangkok	Beijing	Bishkek	Calcutta	Cebu	Chenai	Chiangmai	Chittagong	Chonburi	Columbo	Davao	Delhi	Dhaka
Production/Population ($m^3/d/c$	0.72	0.67	0.09	0.53	0.34	0.66	0.26	0.08	0.07	0.24	0.14	0.36	0.18	0.13	0.24	0.09
Coverage (%)	99	100	42	82	100	98	66	23	97	65	60	89	58	52	86	42
Water Availability (hours)	24	24	6	24	24	24	10	18	4	20	15	16	22	24	4	1
Consumption (l/c/d)	186	337	120	265	96	112	202	173		135	139	145	165	145	209	9
UFW (%) or NRW (%)	13	50	51	38	8	47	50	38	20	38	35	37	51	31	44	5
Average Tariff (US$/month)	0.06	0.05	0.37	0.31	0.05	0.05	0.01	0.66	0.25	0.3	0.12	0.46	0.14	0.27	0.03	0.09
Water Bill (US$/month)	1	14	8	10	1	1	5	15	3	5	9	7	1	7	2	1
Power/water bill ratio	1.5	2.6	1.5	3.6	6.1	2.7	1.2	1.5	6.5	3.7	2.2	3.7	8.8	2.4	7.7	3.4
Metering	54	3	100	100	100	1	0	100	1	100	100	100	94	100	73	7
Operating ratio	0.37	7.73	0.96	0.89	1.3	0.89	5.25	0.55	0.94	0.49	0.56	0.34	0.53	0.83	1.48	1.01
Staff/1000 connection ration	13.9	15.8	7.7	4.6	27.2	6.9	17.1	9.3	25.9	2.9	27.7	2.6	7.3	6.2	21.4	18.5
New connection (US$)	66	28	78	283	100	115	40	80	41	83	69	83	92	42	15	29
Private sector participation			Meter/ Leaks	Production		Rehabilit		Source/ Pipe	Pumping	Production		Production / Other	Proposed	B&C		B&C

	Hanoi	Ho Chi Minh	Hong Kong	Honiara	Jakarta	Johor Bahru	Karachi	Kathmandu	Kuala Lumpu	Lae	Lahore	Male	Mandalay	Manila	Medan	Mumbai
Production/Population ($m^3/d/c$	0.22	0.15	0.4	0.58	0.11	0.37	0.14	0.11	0.35	0.38	0.33	0.03	0.14	0.26	0.13	0.25
Coverage (%)	76	52	100	100	27	100	70	81	100	62	84	100	80	67	63	100
Water Availability (hours)	18	24	24	23	18	24	4	6	24	24	17	24	24	17	24	5
Consumption (l/c/d)	45	136	112	251	135	193	157	91	200	146	213	16	110	202	131	178
UFW (%) or NRW (%)	71	34	36	38	53	21	40	40	36	61	40	10	60	58	29	18
Average Tariff (US$/month)	0.11	0.13	0.56	0.15	0.61	0.39	0.09	0.14	0.34	0.64	0.2	4086	1.2	0.23	0.27	0.06
Water Bill (US$/month)	1	6	31	12	18	7	5	2	14	52	6	25	51	13	15	1
Power/water bill ratio	5	3.1	1.2	1.8	1	2.1	12.7	7.8	2	1.3	4.9	3.3	1.6	3.2	1.3	7.3
Metering	25	100	100	100	100	100	1	83	100	100	24	100	100	98	100	67
Operating ratio	0.79	0.96	1.63	1.26	0.98	0.61	0.77	0.72	0.6	0.39	0.71	0.6	0.22	0.65	1.2	1.08
Staff/1000 connection ration	13.3	6.4	2.8	10.7	5.9	1.2	8.4	15	1.1	17.1	5.7	7.6	6.3	9.8	4.9	33.3
New connection (US$)	76	45	147	95	10	50	2	49	4	72	7		485	95	81	8
Private sector participation		Production		Prod/ Mngt	B&C	Prod	Future	Mangt / Distr	Prod / B&C			Concess		Concess	B&C	

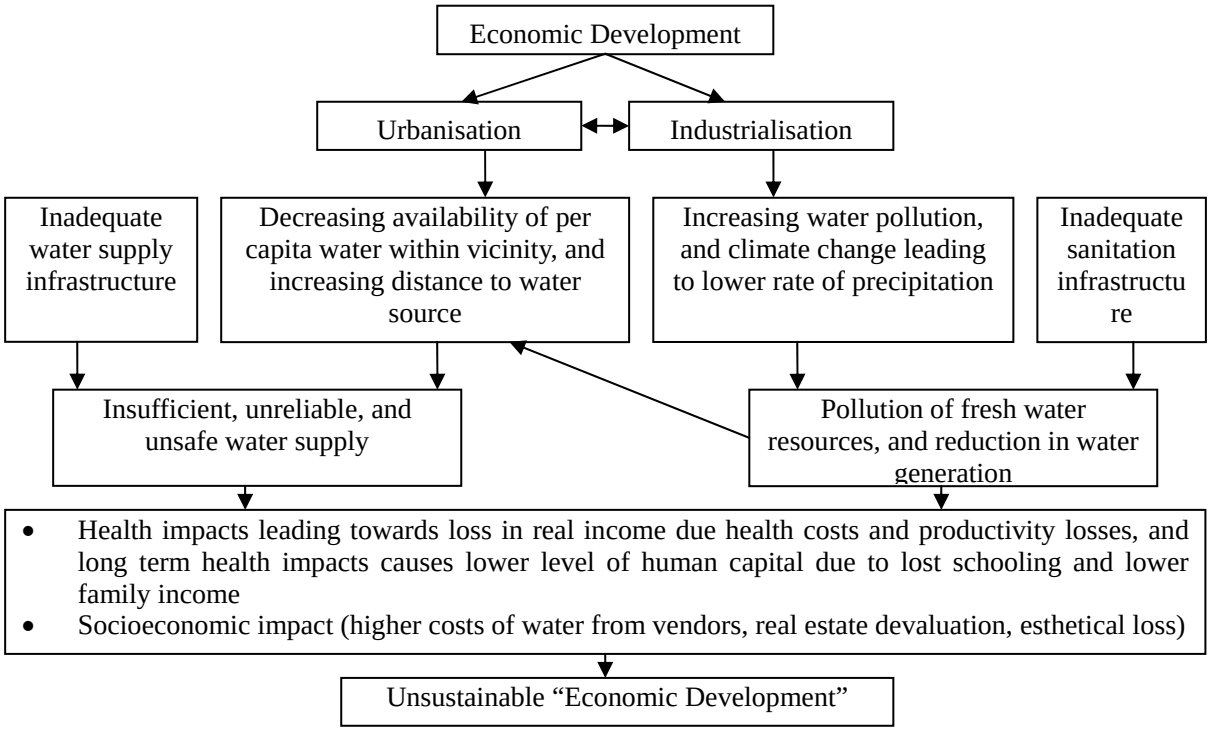
	Penang	Phnom Penh	Port Vila	Rarotonga	Seoul	Shanghai	Singapore	Suva	Taipei	Taskent	Thimphu	Tianjin	Ulaanbatar	Ulsan	Veintiane	Yango
Production/Population ($m^3/d/c$	0.51	0.12	0.36	0.9	0.47	0.58	0.46	0.34	0.72	1.28	1.28	0.33	0.23	0.29	0.26	0.12
Coverage (%)	99	83	98	100	100	100	100	98	99	98	93	100	100	84	54	60
Water Availability (hours)	24	12	24	24	24	24	24	24	24	24	12	24	21	24	24	12
Consumption (l/c/d)	244	32	273	267	209	143	183	135	262	109	93	101	177	157	172	67
UFW (%) or NRW (%)	20	61	26	70	35	14	7	43	37	63	53	11	49	33	39	60
Average Tariff (US$/month)	0.21	0.15	0.49		0.28	0.07	0.55	0.22	0.39	0.02	0.05	0.06	0.1	0.4	0.13	0.46
Water Bill (US$/month)	8	5	22		8	20	12	11	8	1	3	1	1	16	7	19
Power/water bill ratio	4.3	2.3	2		3.3	4.1	3.7	2.7	5.5	9.2	1.9	3.8	4.3	2.8	1.7	1.9
Metering	100	88	100	13	100	100	100	100	100	2	99	100	14	100	100	1
Operating ratio	0.74	0.61	1.12		0.84	1.19	0.6	1.04	0.69	0.85	0.6	1.05	0.74	0.71	0.95	0.27
Staff/1000 connection ration	4.4	13.5	5	3.5	2.3	6.1	2	8.9	1.1	17.9	25.5	49.9	579.2	0.8	16.1	12
New connection (US$)	59	164	151	136	1977		350	11	1079	164	70	362		902	88	900
Private sector participation			Concess		Meter Read		B&C		B&C / Leaks							

Source: Adapted from McIntosh and Uniguez (editors) (1997), Second Water Utilities Data Book, ADB, Manila

Box 2 also shows level of water pollution in major rivers of the region. Untreated industrial wastewater is the major cause of the pollution of fresh water sources. Industrialisation is boosted due to lower productions costs in the region, as environmental costs are quite low. This is either due to less stringent regulations or due to loose enforcement of environmental regulations.

The existing trend of economic development and its impact on water environment is not very encouraging. We have tried to capture this trend in Figure 1. Economic development leads towards urbanisation and industrialisation. Urbanisation is reducing the availability of per capita within the vicinity. The water sources located at short distances are being exhausted due to higher demand. The water sources at long distances require higher energy costs for pumping. On the one hand, this increases the cost of water; on the other hand, it has other environmental impacts, including the use of fossil fuels and emission of green house gases (GHGs), which again contribute adversely towards water environment.

Figure 1 Impact of economic development on water environment



Industrialisation is the major source of water pollution and environmental degradation, which subsequently affects the quality and quantity of water sources. Figure 1 shows that the increasing pace of urbanisation and industrialisation is seriously affecting water environment. Moreover, inadequate water supply infrastructure also restricts the access of clean water and safe sanitation, leading towards severe health impacts. Jakarta is one of the examples in the region that has faced this severity. The short- and long-term health costs and other socioeconomic impacts will hamper economic development. The positive impacts of economic development and globalisation can be capitalised to improve the situation. Furthermore, most of the Millennium Goals are directly and indirectly related with adequate water supply and sanitation services, as shown Box 3.

Box 3 The Millennium Goals

Goal 1: Eradicate extreme poverty and hunger

Goal 2: Achieve universal primary education

Goal 3: Promote gender equality and empower women

Goal 4: Reduce child mortality
- Reduce by two-thirds, between 1990 and 2015 (under-five mortality rate)

Goal 5: Improve maternal health

Goal 6: Combat HIV/AIDS, malaria and other diseases

Goal 7: Ensure environmental sustainability
- Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources
- Halve, by 2015, the proportion of people without sustainable access to safe drinking water
- By 2020, to have achieved a significant improvement in the lives of at least 100 million slum dwellers

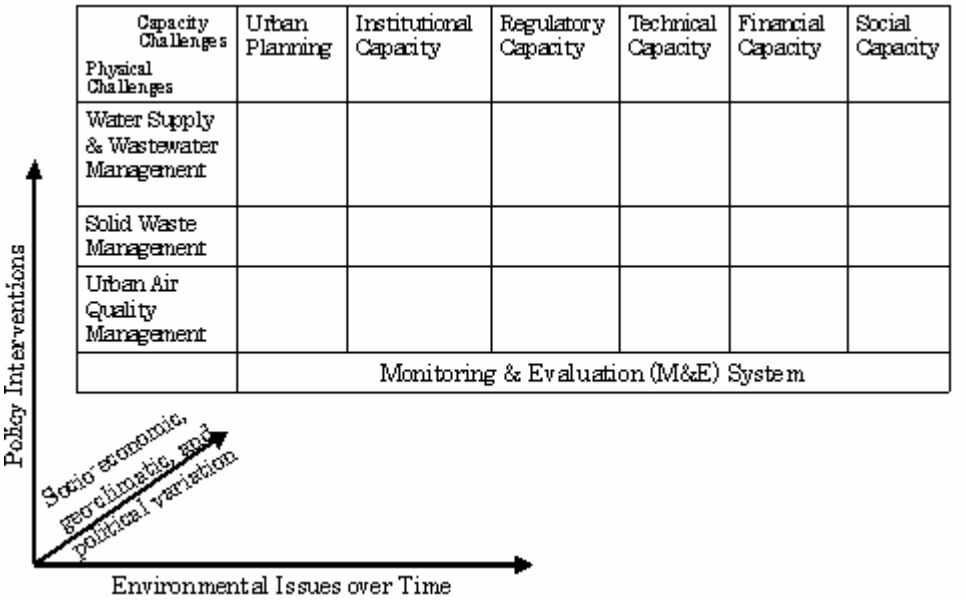
Goal 8: Develop a Global Partnership for Development

2. Overcoming urban environmental challenges

In chapter 1, three main urban environmental issues, viz. waste, water, and air, have been discussed. These issues require an immediate and effective response to bring tangible changes in the urban environment. Hence, capacity should broadly cover the assessment of the issue and then formulate and implement a proper response. Urban environmental challenges, for example waste generation or air pollution, have been varying over time in the same city in accordance with the variations in socioeconomic levels. Similarly, at this time, the different cities in the region face different type or levels of challenges in solid waste management, water and wastewater management, and air quality management.

To plan and institutionalise the appropriate response for a particular type and level of the challenge, a strategic and holistic approach in terms of smart urban planning, effective and efficient regulations, appropriate technology, relevant financial mechanisms, and stakeholder participation is required. The socio-political, geo-climate, and cultural values are quite important to draw this strategic approach as shown in Figure 2.

Figure 2 Capacity building for urban environmental management



Inline with the focus of this thematic seminar, we are focusing on social capacity response for overcoming urban environmental management challenges. Most development scientists agree that public participation is the backbone of successful projects and programmes (Narayan 1995). The decisions, which are meant to affect a group of stakeholders, should be taken with a consensus from all stakeholders. Urban environmental problems involve a wide range of stakeholders from city dwellers to businesses, and from national to international levels. The people living in an urban centre consume products or utilise transport, which may cause pollution; these people are also direct victims of that environmental degradation.

However, the level of polluting the environment may be different than the environmental impact for the same person. For example, a person using an air-conditioned car on a street in Manila may be less affected by the pollution from that car, then a pedestrian on that street. Similar patterns can be seen at the national level, as rural people may be affected by urban pollution, which is deteriorating their air, rivers, ground aquifers, and soil. Similarly, they are producing agricultural products for urban dwellers with the increased use of chemical fertilizers and pesticides. Regional and international partnerships with urban centres are also of the same nature, having business links and are also affected as a result of regional environmental (acid rains, fog clouds, and so on) or international impacts (climatic changes due to GHGs). Moreover, international and national agencies have development commitments, which also make them active stakeholders for urban environmental decision-making.

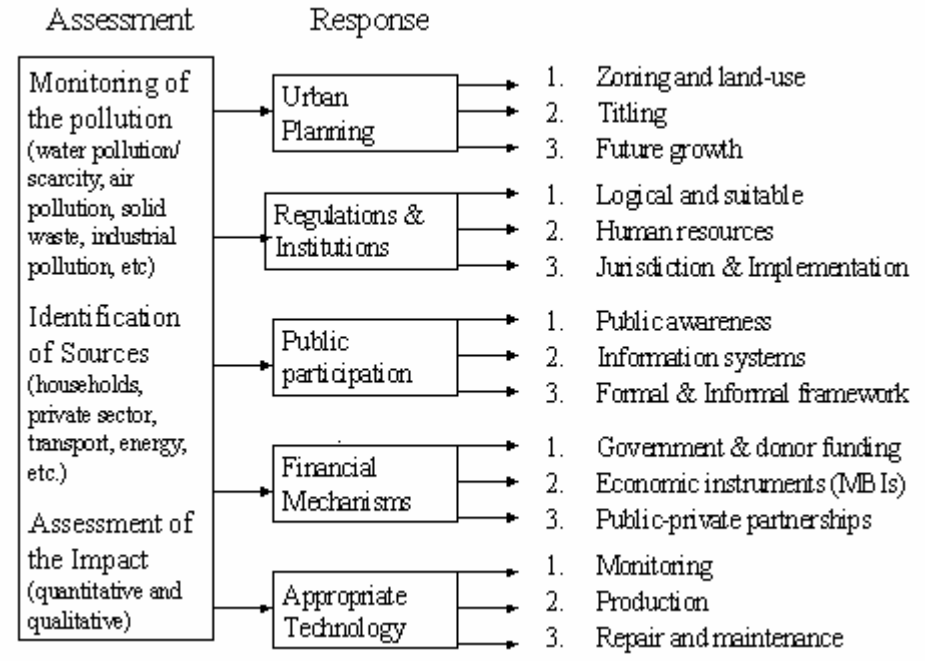
Public participation is required to be induced through proper institutional arrangements, even if it is termed

as “informal.” Local governments, which are directly accountable to the local people, should be the centre for stakeholder participation (Esman and Uphoff 1984). They should be given more powers to take decisions that affect the local people (Shah 1998). Furthermore, the local governments may create a central point for national and international agencies to understand the local point of view and vice versa. The capacity of local governments to involve all the stakeholders in decision-making and implementation is the most essential condition for urban environmental management.

An in depth-analysis of theoretical concepts as well as practical aspects of community participation is part of a paper in this report, “Community Participation in Water Supply and Sanitation Schemes around Hyderabad (Sindh), Pakistan.”

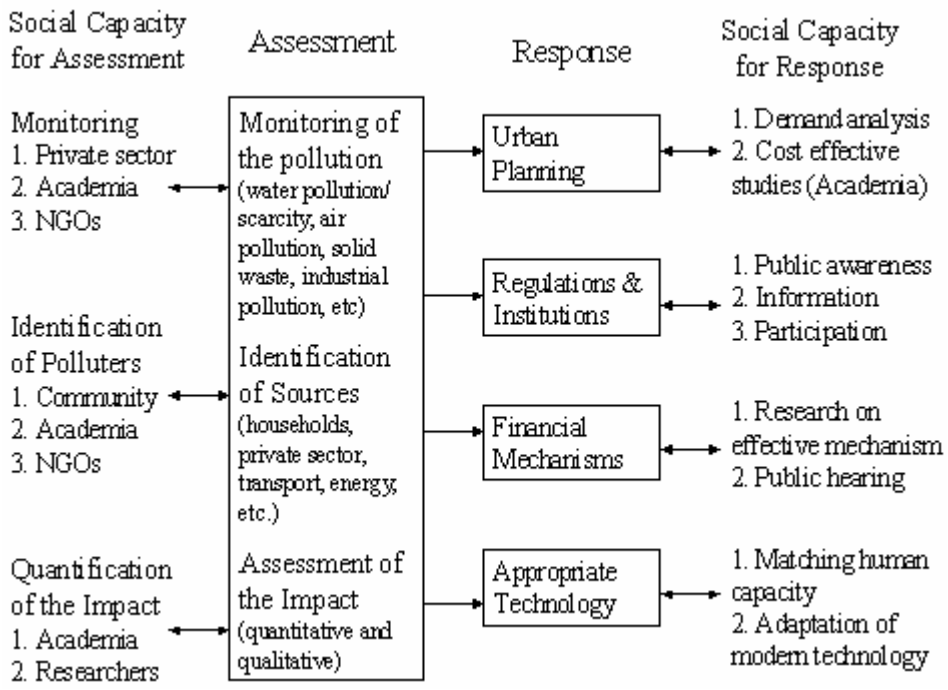
A logical framework for urban environmental management may cover the assessment of environmental issues and the planning and implementation of appropriate responses. The assessment should cover current and future environmental issues including pollution levels, sources, and impacts. Hence, monitoring and prediction can lead towards cause and effect analysis. For this, the cities should be able to have their monitoring facilities collect the required data on pollution levels, and should be able to predict future trends, as most of the measures have to be taken for longer time periods due to the cost and effort involved. This framework for urban environmental management can be used as a critical path analysis to assess the situation and provide the required response, as shown in Figure 3.

Figure 3 Assessment and response capacity for urban environmental management



To build assessment and response capacity, it is vital to optimise the use of public participation in terms of local resources. These resources could be available in terms of private sector, academic and research institutions, and civil society, in addition to the public sector (Figure 4). Most of the cities in developing countries lack monitoring capacity. They do not have sufficient human resources and appropriate technology to monitor pollution and ambient levels. It takes a very long time for the city governments to procure the equipment and train their human resources. To bridge this gap, the private sector, research institutions, and some large NGOs may be approached to assist in monitoring activities. Identification of critical pollution sources could also be done in assistance with civil society and academia. The most critical part on the “assessment” side is to quantify the impact of the pollution, as this will lead to efficient “response” strategies. Even in developed countries, public agencies involve researchers, academia, and NGOs to do this quantification, partly due to professional requirements of this work and partially to show that “impartial” experts, neither polluters, nor regulatory bodies, are involved.

Figure 4 Local resources for building assessment and response capacity



Similarly for building the "response" capacity, local resources can play a vital role. Urban planning requires expertise, which can come from academia or research groups. Appropriate regulations are those which are suited to local conditions and create a win-win situation between environmental protection and economic development. Hence, public awareness and participation is key to clarify the modalities for smooth implementation of the regulations. To plan and implement relevant financial mechanisms, including tariffs and private sector participation, public hearings and public confidence is very important. Lastly, for adaptation of appropriate technology, the industries or transport sector should be involved to obtain their confidence in sustainability and long-term profitability.

3. Analysis of presentations from this thematic seminar

Firstly, we present the analysis of individual cases, followed by an overall analysis of the presentations.

3.1 Analysis of individual presentations

All of the presentations were distributed into three categories, viz.: public participation in water supply and sanitation, public participation in solid waste management, and modes to improve public participation. This is a soft classification as a few of the presentations may not directly fall under any of these categories and is used to avoid forming more categories for one or two presentations. Under the first category, there are seven presentations. There are five presentations under the second category, and three presentations under the last category. All of the presentations are part of this report and a brief analysis of each presentation follows.

i. Environmental preservation activities by local citizens in Kitakyushu

This paper highlights the activities of local citizens in one of the densely industrialised cities of Japan to revive biodiversity within urban areas. Kitakyushu city is located in the northern part of Kyushu, the western island of Japan. Industrialisation in this city started in 1901 with the state owned Yawata Iron and Steel Works, which was a leading steel industry. Due to industrialisation, urbanisation spread rapidly and overtook sub-urban areas. Industrial pollution became a major issue, and there was a considerable loss of biodiversity.

Role and participation of local citizens is very important to preserve nature and to regenerate the lost

biodiversity. There are many grass-root organizations in this city, which are actively involved in environmental related activities. This presentation highlights the activities by some of the environmental groups in Wakamatsu ward of Kitakyushu city. A non-profit organization (NPO), the Kitakyushu Biotope Network Research Group (NPO KBN), was founded in 2001 to carry out activities leading towards environmental protection. These activities are focused on the preservation and restoration of nature in the urban and suburban area, and deal with environmental education.

There are four major activities, which are being carried out by this group. These are: forest and bamboo forest preservation, river and seashore protection, agricultural activities for children, and the biotope project in the Kitakyushu Science and Research Park. The first activity is targeted to thin out bamboo forests, as there is no demand for bamboo, making it difficult to cut these trees on commercial basis. Therefore, voluntary cutting of trees by local citizens is being promoted through environmental awareness. The cut bamboo is chipped, and these chips are used for soil making products.

The second activity was comprised of cleaning of the northern beach of the Wakamatsu and Egawa rivers, as well as environmental awareness by arranging walks and other activities alongside the river and the sea. The third activity is basically aimed to raise awareness of urban children about agricultural and nature related issues. Elementary school students are invited to take part in practical activities such as rice planting and harvesting, and rice cake making. The fourth activity aims at increasing awareness of urban forestry and green spaces. Within the Science and Research Park, a temporary parking place is allocated to re-generate green space with the help of local citizens.

The most important outcome of this presentation is the involvement of local citizens in practical actions leading towards environmental protection, as well as awareness and education. The other important lesson is to take a lead in arranging these activities, as the first step is always difficult. The third important lesson is the sustainability and consistency of these activities over the years with creative approaches.

ii. Awareness materials for wetland conservation

This presentation was made by the Environmental Education Project of the Institute for Global Environmental Strategies (IGES) on their package of modules for wetland practitioners in South Asia and Southeast Asia. This package aims to improve the situation of environmental education, which is hampered due to lack of teaching materials. To develop this package, local stakeholders are involved and five action agendas were identified, with the aim to strengthen the capacity of stakeholders by encouraging/supporting the development, testing production and dissemination of innovative educational materials suited to local contexts.

There are two basic assumptions to develop this package, viz. environmental problems are a common concern, the solution of which requires the active and responsible involvement of the entire community, and collective action is possible only when all stakeholders of a community develop a common understanding about the issue. The package is based on four steps: Learn (L) about the issue thoroughly, Experience and Evaluate (E) the knowledge, Adapt (A) the knowledge for a specific community, and Promote (P) the knowledge. The objective is to create willing, able, and informed citizens on the wise use of wetlands and their resources. Modules within the package are targeted for different groups within the community, as wetland conservation affects various groups differently. This is a testing period for this package to see its validity as well as transferability from one country to another, with different socio-economic characteristics.

The outcome of this presentation is to show the process of developing comprehensive modules for environmental education. The clear setting of objectives, involvement of stakeholders, and action-based learning is important. Pilot testing and improvements, as well as appropriate changes for its transferability to other countries can make these education modules effective.

iii. Public participation in environmental improvement in Semarang

Samarang city is the capital city of Central Java Province (Indonesia). This presentation highlights the BINTARI-KITA Partnership Programme for a pilot project on aqua-environmental improvement in a model river basin. These improvements will be achieved by reducing the urban pollution being generated

from this city, which is damaging the Bajak river basin. The Kitakyushu International Techno-Cooperative Association (KITA) and the Japan International Cooperation Agency (JICA) of Japan are actively working with local stakeholders on this programme. The major polluters have been identified as bean curd (tofu) factories and improvements would be achieved in terms of reduction in BOD and COD levels, as well as improvements in biota living in and around the river flow. The important steps would be to improve the city government's administration capacity, improve river water monitoring, construct pipelines for collection of wastewater, develop energy-efficient affordable wastewater treatment technology and construct the wastewater treatment facility, transfer Japanese bean curd (*tofu*) production technology and hygiene management technology, and promote environmental education and cultural exchange programmes.

To involve the community, consultation and discussions with some community groups have been carried out since the pre-proposal stage of this programme. These groups include community organisations, community *tofu* producers, local government officers, groups from universities, and other related government institutions. Based on the aims and process of the community involved, it is recommended that community participation should be realised from the inception of the programme, the plan of the programme should be well propagated and discussed with all community groups, advice and comments from these groups should be taken as input to revise the programme, the groups should be given active roles during the implementation of the programme, the community's capability should be enhanced so that they can manage this programme on their own, and the roles of government institutions, as well NGOs, should be revised to supplement the community's capability.

The important outcome of this presentation is the international cooperation to boost public participation. Most of programmes under international cooperation do not run smoothly once the international donors complete their active commitment. Hence, to achieve sustainability of the programme, it is very important to enhance the capability of local partners, as well as to redefine their roles. For this, all stakeholders should be a part of the programme from inception, and continuous consultations should be carried out to revise the plans on "learning process" principles, rather than implementing a centralised plan on "blue print" principles.

iv. NGO activities in Cebu for environmental education for river quality

Cebu city is located 584 km south of Manila (Philippines). This presentation highlights the activities by university staff and students to improve river quality. The major damage for river quality is due to disposal of solid waste. Although per capita waste generation is about 0.5 kg, there is lack of proper facilities to dispose of daily waste of about 500 tons. Most of the waste ends up in the river, which has led to devastating damage to the quality of water and soil.

To improve the situation, the University of Cebu launched a "zero-waste" management programme, and started awareness raising activities, as well as practical activities including monitoring of the river quality and plantation. For "zero-waste" management, the university started campaigns to reduce the waste through recycling, as well as non-consumption of the items which generate waste. Various student activities are being organised to increase recycling by showing ways to recycle. Students and local citizens are involved in monitoring the waste accumulation in the river and set-up of cleaning activities as per the results of this monitoring activity. The plantation of trees is also being carried out to protect the banks of the river, as well as to improve environmental awareness among the community.

The important outcome of this presentation is involvement of the university in these activities, as traditionally universities are places for academic learning. This is new trend in developing countries, where universities, mainly science related departments, are not actively involved in community related activities. The other outcome is the involvement of private business groups to support these activities. The banner of "Pepsi Cola" is shown in one slide; it is very important to seek the support of such businesses, as that support not only helps towards meeting the financial costs of carrying out the activities, but also raises the awareness of these private groups to increase the recycling with their products.

v. Community participation in water supply in Hyderabad

This paper and presentation discusses the concepts, implementation, and impacts of community

participation in environmental services like water supply and sanitation. Water related health impacts are enormous, as they affect short and long term quality and quantity of the labour force. Furthermore, most of the Millennium Development Goals (MDG) are directly and indirectly related with the adequate provision of water supply and sanitation. One of the goals is targeted to cut the number of populations without water supply and sanitation by half until 2015, and improve the living conditions of the slums; that, again, depends on water supply and sanitation.

Most of the investment and efforts to improve the adequate supply of water and sanitation services did not turn out a great success, as the public sector's centralised decision-making and implementation of projects fall short of the demand for quality, reliability, and quantity of the services. Efficiency was low due to higher provision costs and less recovery of user charges. Therefore, the project, discussed in this presentation, is targeted to boost community participation, to facilitate the involvement of communities in decision-making and implementation. The communities should own and operate their water supply and sanitation. The difference between the public sector and community-based provision of the services lies in the decision-making and implementation based on blueprints versus learning processes, centralisation versus decentralisation, and the well targeted and defined process for community participation. The process of community participation should be inherited from the inception of the project.

In the water supply schemes around Hyderabad (Pakistan), the community participation process is demand responsive, and the communities have to have consensus, after which they will approach the project office. The community must undergo six to twelve months of the process to show that they are capable of maintaining these schemes after take over by regular collection of user charges, as well as adapt health and hygiene practices to multiply the health impacts of water, and keep women and community organisations intact on democratic principles. The evaluation of completed schemes, by adapting non-market valuation techniques, shows that there are considerable health impacts resulting in higher willingness to pay for these services. Furthermore, these community and women organisations are using this platform to undertake other development projects, and resolving social conflicts within them.

The major outcomes of this study show that community participation is vital to improve efficiency and effectiveness of environmental services; however, community participation needs careful implementation. Time and skills are required to plan and institutionalise this process, so at the end of the day, communities can manage these services on sustainable basis. The co-benefits of community process can turn a vicious circle into a virtuous circle for these poorer communities.

vi. Orangi pilot project in Karachi

This presentation discusses the current decentralisation process in the local governments in Pakistan and discusses the "self-help" based sanitation project in one of the biggest slums in the world, located in Karachi (Pakistan). The recent decentralisation has brought more freedom and flexibility for the city governments to perform their duties, especially for the provision of environmental services like solid waste management, water supply, and sanitation. The City Nazim (Mayor) leads the local government. The District Coordination Officer (DCO) is administrative head of this government. The local government has 15 departments including water supply and sanitation to legal systems. Financial freedom is in terms of collection of various taxes. However, due to the large size of the city and the challenges it is facing, these finances, including support from national and international agencies, fall well short of even providing basic amenities to all the residents.

Slums are the worst hit, as all the services either never reach the consumers or reach them very late. The sanitation problem was the major cause of many diseases and inconvenience in the Orangi slum, where about 1.2 million people live. The Orangi Pilot Project (OPP) was started to overcome this problem on a self-help basis. The community leaders were motivated and a labour force for each street was trained. The initial financial costs were met from borrowing. All the households borrowed a small amount of money to meet their costs, and the payback rate was 98%, which is much better than the banking system. After the sanitation problem was resolved, this trend of micro-finance was diverted to help women start smaller businesses. The payback is remarkable, and OPP has become one of the symbolic projects with international agencies like the World Bank. Now the local government is trying to connect this sanitation system with the overall wastewater treatment system of the city.

The major outcome of this presentation is that a motivated community, trained labour force, and micro-finance can help bring various environmental services. The community-based micro finance has a very good payback rate, and this can also lead to the use of this system for other smaller businesses involving women.

vii. Yokohama waterworks' environmental activities

This presentation highlights the activities carried out by Yokohama Water Works (YWW) to raise environmental awareness. Yokohama is one of the biggest cities in Japan and is located side by side with Tokyo. Due to unavailability of water sources within the Yokohama limits, the water intake is located in a different geographical and administrative location. Therefore, cost of provision water as well its externality, mainly for the water intake area, is quite high.

There are two major objectives of the activities. One is to raise customer awareness for the high costs and externalities, so consumers in Yokohama city should understand the real price of using water and may conserve water. The second object is to gain the confidence of the community at the intake area. The consumers groups are being brought on site to show various environmental activities. There is awareness regarding drinkable water and related technology. The volunteers also take part in managing the forest around the water intake area.

The important outcome of this presentation is that raising consumer awareness regarding costs and externalities is very important to influence behaviour changes for conservation of natural resources, and to let consumers realise the "ecological footprints" of their urban activities. On the other hand, the communities, who suffer due to these "ecological footprints" should also be taken into confidence and compensation afforded to them.

viii. Solid waste management in Dhaka

Dhaka, the capital city of Bangladesh, is densely populated city with very high growth rate due to rapid urbanisation. The local government, Dhaka City Corporation, lacks resources to even provide basic amenities, like solid waste collection and disposal, to all of the residents. Furthermore, the Municipal Ordinance 1983 (amended in 1999) and Environmental Conservation Act 1995, which are the legal foundations on solid waste management, do not cover solid waste disposal and management comprehensively. This leads towards dumping of every type of waste in the streets, and lack of facilities to collect and dispose that waste.

Communities in Dhaka are quite active in the arrangement of their own services for the collection of the waste at the primary level. However, this creates a "not in my backyard" syndrome, as the residents dump waste on the main streets, where the collection and disposal arrangements are neither sufficient, nor coordinated. Community groups are also trying to promote composting and recycling activities to reduce the amount of waste for final disposal. All of these community activities can help to improve the level of overall solid waste management, if these are well integrated with each other, the private sector, and the local government.

This presentation highlights a pilot activity of the Kitakyushu Initiative in Dhaka City. This pilot activity is targeted to improve solid waste management capacity of Ward 22 in Dhaka city by supporting a community based collection system and its integration with the local government's collection and disposal system. This will provide grounds for the integration of community activities from the other wards of the city.

The main activities under this pilot project are: public awareness for proper disposal of the waste by households, including segregation of recycling materials and disposal in proper bags at proper times; collection and disposal at the transfer site by the community workers; construction of transfer stations by the local government for secondary collection; and provision of proper vehicles at proper times to collect the waste from transfer stations.

The major output of this presentation is international cooperation's changing role from direct technical aid to support local initiatives. These initiatives may bring sustainable results, even after the completion of

international cooperation. The other outcome is the importance of the integration of various activities being conducted by the community, and the private and public sectors to optimise impacts. This integration also fosters trust among these groups leading towards strong partnerships.

ix. Solid waste management in Nonthaburi

Nonthaburi is a small municipality within Greater Bangkok. Most of the people working in downtown Bangkok city have houses in this municipality. Hence, this is a middle class society with comparatively higher rates of consumption and waste generation. To facilitate the efficient management of solid waste, Nonthaburi approached the Kitakyushu Initiative Network for support of a pilot project to increase the rate of recycling and to reduce the rate of final disposal. This project was targeted to increase recycling by 20% and reduce final disposal by 30%, mainly through segregation at source and selling of recycling waste by the municipality.

Communities were involved through intensive public campaigns by the political leaders and mass media. The households were provided with clear plastic bags to dispose of their recycling waste on certain days. The municipality bought a new collection vehicle for collecting recycling waste. The municipality sells this recycling waste and distributes the earnings equally between the staff, for their motivation, and the community. Hence, this activity is continuing, even after the completion of pilot project.

The important output of this presentation is that there is lot of invisible recycling waste mixed with normal waste, and proper awareness and incentives help to increase the rate of recycling and reduce the rate of final disposable waste. The other important output is that partnerships between the community and local government can be fostered through political will, as well as through the practical steps taken by the government.

x. Public participation in solid waste management in Cebu

This is another presentation from Cebu city. This highlights the role of the local government in boosting community participation in urban environmental management. The current devolution of government roles has brought about the revitalisation of the City Planning and Development Office and the strengthening of cooperation between private and public sector for urban environmental management. NGOs are intensively involved in various activities, as the target for City Development Council is to increase their membership from 28 to 54, provide them access to the City Budget, and arrange collaborations for various tasks. There are few areas of concern in this regard: need to harmonise and integrate efforts of all the local stakeholders in urban environmental management; creation of an Environmental and Natural Resource Office (ENRO); advocacy programmes for citizen's awareness and participation; and cooperation with adjacent local government units.

An example of community waste management (KPB) was highlighted. This pilot activity started in October 2001 in 5 *barangays* and has now expanded to six areas since 2003. For formation of Task Force, data was collected from various groups at each *barangay*. These task forces will form Environmental Cooperatives; as waste is everybody's by-product, therefore, a multi-stakeholder as well as multi-sector approach is necessary. Therefore, the government, private sector, and various community groups are involved to decide and implement solid waste management in Cebu.

The major outcome is the devolution of roles and responsibilities, as well as integration of these roles and responsibilities under one umbrella. Multi-stakeholder and multi-sector approaches are important for solid waste, as there are different types of wastes, different types of groups generating that waste, and different type of collection and disposal methods. To optimise the efficiency and effectiveness of overall solid waste management, this case is an example of a good practice.

xi. Actions of residents in environmental activities in Ube city

Ube city is a comparatively small city in Japan. It is famous due to its solid waste management system. Stringent laws were targeted to reduce the pollution from incinerators (dioxins), and goals were set to reduce the waste. This has led to the renewal of various incinerators, as well as checks of the content of the combustible waste. The target of collected combustibles for 2009 is 96.85 tons/day, compared to the actual

rate of 109.67 in 1999. The target for self-delivered combustible waste is 55.42 tons/day, compared to 61.21 tons/day during the same time period. Recycling of combustible target is to reduce waste from 3.12 tons/day to 2.49 tons/day during this time period.

Citizens' participation in waste reduction is very important; hence briefing sessions were held 340 times within 8 months, and various mass media campaigns were launched. The target is to sort the waste with the cooperation from citizens, reduce business waste, and improve the level of incineration for reduced level of pollution.

The important outcome of this presentation is that in the cities of developed countries, the pollution from incinerators is becoming a major challenge, and waste reduction strategies, in addition with better incineration technology, is the solution. Furthermore, for waste reduction targets, community awareness and their participation is vital, especially of the business community in the developed countries.

xii. The challenges for an environmental city Minamata

Minamata, a small city in southern Japan, is famous due to Minamata disease, which was result of industrial pollution. While overcoming this challenge, the community established a closed bond between themselves, as well as with the local government and the private sector. This is helping towards effective urban environmental management in this city. The city government facilitates various activities to turn community participation into effective urban environmental management.

These activities include debates on various strategies, waste sorting by different categories, production of eco-shopping bags by women groups, pursuing supermarkets to implement waste reduction strategies, raising awareness of children at schools for proper waste disposal and cleaning, and so on. The city government has also supported the establishment of various eco-industrial units including facilities for bottle re-use, electrical appliance re-use, and so on.

The major outcome of this presentation is the importance of the role of the local government to divert community spirit for effective urban environmental management. The city government facilitates smaller activities, such as sorting of waste, as well as larger activities including the establishment of an eco-town.

xiii. Importance of environmental education in public participation

This presentation reviews Japanese experiences and assesses the Asian context for the role of environmental education in public participation. Japan had community groups within the neighbourhoods, which still exist and provide forum for various community activities. However, with economic development and migration to larger cities, these groups became weak. To replace these groups, NGOs started appearing in the 1990s. Surveys show that 79.9% of 1094 local governments adopt public participation in various functions and decision-making. Hence, public participation can also play a vital role in urban environmental management. Environmental education is very important in boosting public participation in environmental activities. This education became very popular in developed countries after the 1970s. In Japan, environmental education became very popular in the wake of industrial pollution, which led to various damages, including Minamata disease.

For promotion of environmental education, there should be clear objectives, interest groups, knowledge, and integration within the regular education system. After improvements in the local environment in Japan, the focus from local issues has changed to global issues, including climate change, since the 1980s. The role of various actors including NGOs, teachers, community associations, and administrative bodies is vital to plan and implement environmental education at various levels and in various forms (formal and informal).

In developing countries like Indonesia and Bangladesh, environmental education has not yet been integrated into the regular system, as the salary of teachers is quite low, so they carry out part-time jobs, instead of learning skills for delivering environmental education. However, there are active social groups including NGOs, which carry on informal educational activities. Moreover, religious values for "purification" play an important role to understand environment.

The major outcome of this presentation is the use of local groups and local knowledge in establishing formal and informal environmental education. Furthermore, environmental education can lead to environmental awareness; however, environmental awareness, based on religion and local values, may lead to the establishment of environmental education activities.

xiv. Environmental education in Kitakyushu

Kitakyushu city is very active in promotion of environmental awareness and public participation for urban environmental management. Awareness and participation could be effectively fostered through environmental education. This presentation shows the various environmental education activities by the city. The city has recognised that environmental education is a combination of various forms of education including science, life and culture, outdoor, intercultural, consumer, urban planning, conservation, and industrial pollution. After setting the target for the outcome of environmental education, for example preserving environment and biodiversity, the city works on the necessary elements for making this education a success. These elements are finance, human resources, information and knowledge, networks of various stakeholders, and the focal point (children, adults, NGOs, industries, etc.).

This presentation highlights environmental education for children. The first step is production of educational materials from nursery to junior high school children. The second step is outreach activities through well-trained human resources. There are on-site trainings and visits to show the practical aspects of what is written in the books. The third step is formation of an eco-club for children, where they carry on their own activities to “learn by doing.” The aim is to create a “conscious” society in the future, when these young children will turn into adults. Moreover, when these “conscious” adults will retire, they will volunteer themselves for similar activities. Hence this will be a virtuous circle.

The city has created various museums, gardens, and other establishments to promote environmental awareness. This is well integrated with local residents, businesses, academia, and other groups. The aim is to develop “environmental minds” leading towards a sustainable city.

The major outcome of this presentation is the logical planning and implementation of environmental education. The clear targets, resources, focal point, and networking provide a good basis to launch environmental education. Moreover, environmental education should be a part of regular education in order to continue on a sustainable basis, and there should be continuous circle of volunteers.

xv. eLearning to facilitate public participation

This presentation highlights eLearning activities of IGES. The objective of these activities is to build capacity for better environmental management. In this regard, various courses have been developed and there are interactive learning facilities with the help of internet facilities and computers. The target audiences are policy-makers and the content of the course is mainly the outcome of the research for different environmental challenges. However, due to limited access to the internet facilities, outreach is not that wide and costs are high.

The important outcome of this presentation is that due to higher costs and limited access, eLearning should be integrated with formal face to face training, until there is high number of internet users and lower costs.

3.2 Overall analysis

A concise summary of presentations is shown in Table 3. Most of the presentations are focused on water and wastewater, and solid waste related urban environmental challenges. A few presentations also highlight the challenges in air, biodiversity, and combination of various issues. Water supply and sanitation services to urban slums are a major challenge for local governments, in view of budgetary, as well as urban planning constraints. Solid waste is a challenge due to unsystematic disposal and collection. Segregation at source is not a common practice, and disposal at proper times with proper bags is also very rare in most of the cities. Final disposal is only through open dumping, as governments do not have funding, nor implement user charges. The reduction of solid waste for final disposal can be achieved by increasing recycling and composting activities. A detailed review of these environmental challenges is already presented in the first section.

Table 3 Public participation in urban environmental management

Challenges	Driving Forces	Modes	Tools & Strategies	Partners & Integration
Water & Wastewater SWM Air Biodiversity Overall UEM	Political Will Governance Institutions: Decentralization Regulations & Laws Economy/ Market Public pressure	Partnership Management Ownership/ Local Initiatives Consumer behaviour (Conserve, WTP, etc.)	Formal & Informal Education Action-based Learning e-Learning Campaigns Meetings	Civil Society including CBO, NGO, Academia Business/ Private Sector Government International Agencies & Initiatives

Most of the presentations were focused on the identification of important driving forces, which are mainly responsible to force various stakeholders to promote public participation. The most important driving force is political will of the individuals or groups, who are in power or who are primarily responsible for various environmental related services and activities. Most of the changes in the formal and informal mechanisms to involve the public are dominated by the will of the people, who are in leading positions. Therefore, if a mayor is very active, then there are visible changes in the government. This also brings in the second driving force of "governance" into the picture. Most of the international agencies, NGOs and other groups are putting pressure on "good governance," which should involve the public in decision-making and implementation. There should be transparency in the process, which can be achieved with better information dissemination and public participation.

The third driving force is "institutions," as the changing role of institutions brings public participation into action. The roles of institutions are being re-invented due to "decentralisation" and "devolution" of powers from the central government. New regulations and laws also influence institutions to take up new roles, where public participation has high priority. The fourth driving force is the economy or market. New trends in the economy, as result of localisation or globalisation of products, may also influence governments to change the way they govern. The last but most important factor is public pressure, as we have seen that public pressure in many cities has led towards active public participation in urban environmental management.

There are various modes to induce public participation. The most effective is to build partnerships among various stakeholders, including community groups, business sectors, and governmental departments. The second mode is to assign management tasks to the communities or private sector. This is mainly, where public sector management is weak or inefficient. The third is ownership of the services by the community groups, as we saw in water supply, sanitation, and solid waste management. The fourth is to influence consumer behaviour, so the community may participate in environmental management through either waste reduction or optimising waste collection.

There are a number of tools and strategies for inducing public participation. First of all, formal and informal environmental education is the most important tool. This is followed by action-based learning, by involving community groups in carrying out volunteer work and demonstrating to children how things work. eLearning is another tool, which could be used together with face-to-face learning. Last but most effective for immediate results is public campaigns, either by arranging meetings or through mass media.

To make public participation a success, various community activities must be harmonised through partnerships and integration. Civil society, including community groups, NGOs, and academia are the most important stakeholders, and there should be integration among themselves, as well as the private sector and local government. Moreover, international cooperation is important to support the local initiatives being undertaken by community groups, the private sector and the government.

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Annex I

Solid Waste Generation and Management in Different Cities

	DHAKA (BANGLADESH)
General information	
Area:	360km^2
Population:	10 million
National GDP per capita:	USD 1,602
Total income:	BDT 2098 million (USD 37 million)
Solid waste generation	
Total generation:	4500-5000 ton/day
Waste generation per capita:	0.60kg/person · day (residential area)
Waste source:	46.8% households, 21.8% street sweeping, 19.2% commercial, 12.9% industrial, 0.5% clinical
Waste composition:	72.5% food, 13.7% polythene, 5.6% paper/cardboard, 3.3% plastic
Solid waste management	
Collection rate:	Estimated at 50-60%
Recycling:	Estimated at 26%; carried out by scavengers
Composting:	Conducted by residents together with NGO initiative
Expenditure:	BDT 53.00 (USD 0.90) per capita expenditure; 32.57% collection, 47.9% transportation, 19.37% disposal, Conservancy tax of 2% is charged. Expenditure rate of the total budget is 15.4%.
	CEBU (PHILIPPINES)
General information	
Area:	326 km^2
Population:	0.72 million
National GDP per capita:	USD 3,971
Total income:	PHP 1257 million (USD 24 million)
Solid waste generation	
Total generation:	511 ton/day
Waste generation per capita:	0.71kg/person · day
Waste source:	57% residential, 43% non-residential
Solid waste management	
Collection rate:	80%
Recycling:	Scavengers (200-300 persons) have developed a cooperative and entered into a MoA with the city government. Cebu Department of Public Services and NGOs also carry out separation at source.
Composting:	1 ton/day is collected from market
Final treatment:	Landfill (capacity of 938,400m^3; lifetime of 6-7 years)
Expenditure:	In 2000, PHP 76 million (USD 1.4 million) was appropriated for SWM, approximately 6.3% of the total expenditure.
	NONTHABURI (THAILAND)
General information:	
Area:	39 km^2
Population:	0.27 million
National GDP per capita:	USD 6,402
Total income:	THB 331.3 million (USD 7.7 million)
Solid waste generation	
Total generation:	320 ton/day (292 ton/day collected)
Waste generation per capita:	1.08kg/person · day
Solid waste management	
Collection rate:	90% (frequency = twice a week)
Recycling:	5-10%, separation at source by community
Expenditure:	In 2001, the total expenditure was THB 70.6 million (USD 1.6 million), a rate of 23.2% in the total expenditure of all municipal departments.

ULAANBAATAR (MONGOLIA)

General information

Area:	1,359km^2
Population:	0.82 million
National GDP per capita:	USD 1,783

Solid waste generation

Total generation:	1,500-1,800m^3 (645-774 ton/day)
Waste generation per capita:	0.0012-0.005m^3/person · day (0.52-2.15kg/person · day)
Waste source:	50% households, 30% industries, 20% other
Waste composition:	25.2% paper, 9.2% synthetic bags/paper boxes, 2.9% synthetic material, 2.5% cotton material, 4.4% glass, 5.5% cans, 2.5% metal, 2.6% plants, 2.6% vegetables, 4.5% bones, 21.4% ash, 3.7% coal, 8% soil/stones, 5% other (In winter, 60% is ash.)

Solid waste management

Collection rate:	71.4%, private sector carries out collection and transport
Recycling:	0.0025-0.013m^3/person·day (1.1-5.6kg/person·day) (Through scavengers)
Final treatment:	Landfill, 2 sites
Expenditure:	User fee of MNT 50/month (USD 0.04/month)

CHONGQING (CHINA)

General information:

Area:	82,000km^2
Population (millions):	31 million
National GDP per capita (city GDP):	USD 3,976 (USD 600)

Solid waste generation

Total generation:	7500 ton/day
Waste generation per capita:	0.24kg/person · day
Waste source:	7500 ton/day (domestic); 35,600 ton/day (industrial) (13 million ton/year); 1228 ton/day (hazardous) (448,400 ton/year)
Waste composition:	35% organic, 40% inorganic

Solid waste management:

Collection rate:	85%
Recycling:	25% (includes paper, rubber/plastic, glass, metal)
Incineration:	Central treatment of 1,700 ton/day of waste (planned)
Final treatment:	Sanitary landfill: total capacity of 3,000 ton/day (planned)
Expenditure:	User charges are CNY 3/household · month (USD 0.4)

KATHMANDU (NEPAL)

General information

Area:	50.8km^2
Population:	0.73 million
National GDP per capita:	USD 1,312
Total income:	USD 5.2 million

Solid waste generation

Total generation:	944 m^3/day (212 ton/day: 0.225 ton/ m^3)
Waste generation per capita:	0.29kg/person · day
Waste source:	99.5% households, 0.5% clinical
Waste composition:	69.80% organic, 8.50% paper, 0.54% rubber, 0.12% leather, 0.73% wood, 9.17% plastic, 0.23% bone, 3.20% textile, 0.87% ferrous metal, 0.05% aluminium, 2.5% glass, 4.33% other

Solid waste management

Collection rate:	70%; Private sector involvement in collection (piloting)
Expenditure:	USD 2 million, a rate of 38% in the total budget Fees are within or less than USD 0.7/household · month

BHOPAL (INDIA)

General information

Area:	285.88 km^2
Population:	1.4 million
National GDP per capita:	USD 2,358

Solid waste generation

Total generation:	600 ton/day
Waste generation per capita:	0.43kg/person · day
Waste composition:	Approximately 50% organic

Solid waste management

Collection rate:	60-70%
Recycling:	Carried out by scavengers
Composting:	Private company composts 20% (120 ton/day) adjacent to the landfill site; compost is sold commercially
Landfill:	75 acres, open dumping
Expenditure:	25% of municipal budget. Current cost recovery includes a conservancy tax as part of property tax/sanitary tax.

FUKUOKA (JAPAN)

General information

Area:	340 km^2
Population:	1.3 million
National GDP per capita:	USD 26,755
Total income:	JPY 722,803 million (USD 5.8 billion)

Solid waste generation

Total generation:	772,916 ton/year (total) (2117 ton/day) 326,544 ton/year (domestic) (894 ton/day)
Waste generation per capita:	0.69kg/person · day (domestic), 1.6 kg/person · day
Waste sources:	42% household, 46% commercial, 2.5% industrial, 1% other, 7.8% accepted from outside city limits
Waste composition:	90% combustible, 7.2% non-combustible and bulky, 2.5% glass/PET bottles (domestic waste)

Solid waste management

Collection rate:	100%
Recycling:	84.5 ton/day, carried out by Fukuoka City
Incineration:	1,777 ton/day
Final treatment:	432 ton/day
Expenditure:	JPN 30,692 million (USD 248 million), a rate of 4% in the general account.

KITAKYUSHU (JAPAN)

General information

Area:	470km^2
Population:	1 million
National GDP per capita:	USD 26,755

Solid waste generation

Total generation:	1,400 ton/day
Waste generation per capita:	1.40kg/person · day
Waste composition:	40% paper, 20% plastic

Solid waste management

Collection rate:	100%; 2 times per week (recycling 1 time per week)
Recycling:	Separated at source by residents (2 recycling plants)
Incineration:	3 plants (electricity sales amount to 7% of revenue)
Final treatment:	Sanitary landfill
Expenditures:	The budget of the Environment Bureau is JPN 17,600 million (USD 145 million), approximately 3.3% of the general account. Half of the budget for SWM comes from general revenue; user fees account for 12%; user charges are obtained from the sale of “designated bags” (JPN 15/bag (USD 0.12/bag)).

MACAO (CHINA)

General information

Area:	25.4km^2
Population:	0.44 million
City GDP per capita:	USD 14,055
Total income:	USD 1.1 billion

Solid waste generation

Total generation:	229,444 ton/year (629 ton/day)
Waste generation per capita:	1.43kg/person · day
Waste source:	72% household, 8% commercial, 15% industrial

Solid waste management

Collection:	Private sector carries out collection and transport of waste
Recycling:	Paper, plastic bottles, aluminium cans (300 recycling points)
Incineration:	Capacity of 778 ton/day, Volume reduced to 20% after incineration
Final treatment:	Sanitary landfill (incineration residue, construction waste, animal carcasses, used tires)
Expenditure:	USD 17 million/year (Collection/transportation: USD 12.7 million, MSW incineration: USD 3.9 million, Landfill: USD 625,000), with a rate of 1.5% in the total budget.

SURABAYA (INDONESIA)

General information

Area:	290km^2
Population:	2.8 million
National GDP per capita:	USD 3,043
Total income:	IDR 980 billion (USD 110 million)

Solid waste generation

Total generation:	1,630 ton/day
Waste generation per capita:	0.58kg/person · day
Waste source:	68% household, 16% market, 11% commercial/industries, 5% street and open space
Waste composition:	56% organic, 4.4% paper, 39.6% other (dry season)

Solid waste management

Collection rate:	Collection is organised by neighbourhood units; City government is responsible for transport of waste to final disposal facilities.
Recycling:	Conducted by scavengers, estimated at 30%
Composting:	In practice
Final treatment:	Semi-sanitary landfill (2 sites, 40.5ha and 16ha), composting, mini-incinerator
Expenditure:	IDR 60 billion (USD 6.6 million) for transportation and disposal, a rate of 6% of the total budget. Collection fees are included in "community fees" (IDR 10,000-30,000/month (USD 1.1-3.2)). Transportation and disposal costs are paid to the city directly and vary from IDR 6,000-14,000/month (USD 0.55-1.5). Total city income from transportation and disposal fees is IDR 15 billion (USD 1.6 million).

YANGON (MYANMAR)

General information

Population:	3.7 million
National GDP per capita:	USD 1,027
Total income:	USD 20 million (MMK 15 billion)

Solid waste generation

Total generation:	3,000 ton/day (1999, estimated)
Waste generation per capita:	0.52kg/person · day (2000)
Waste source:	60% household, 15% market, 10% commercial, 15% other
Waste composition:	58% organic, 1% paper, 4% plastic, 4% animal carcasses/bones, 2% ashes/dust, 11% cane/bamboo, 20% other (wet season)

Solid waste management

Collection rate:	50-60%, private sector conducts collection
Composting:	200,000 bags (25kg) produced in last 15 months
Final treatment:	Dumping, landfill
Expenditure:	Fees: MMK 30-60/month