EKISTICS / ΟΙΚΙΣΤΙΚΗ: the problems and science of HUMAN SETTLEMENTS

Volume 58, Number 348/439, May/June -July/August 1991

Nature and urban nature

Cover: Magnitude of the environmental effort needed— activities, cost, extent, etc. (See John Papaioannou, " 'New Ethics' and the environment," p. 247).

The contents of this issue were compiled and edited by P. Psomopoulos. R.J. Rooke provided editorial assistance. Alex Freme-Skirou proofread the texts, Mary Mavraki was responsible for typesetting, Angela Iliadi Moschona for graphics, Natassa Antoniadou and Eleni Panagiotopoulou for the photography, and Soula Nicolaraki with Zoe Tsiftsi for the final dummy from a maquette by the editor.

Sustainable urban development: Strategic considerations for urbanizina nations

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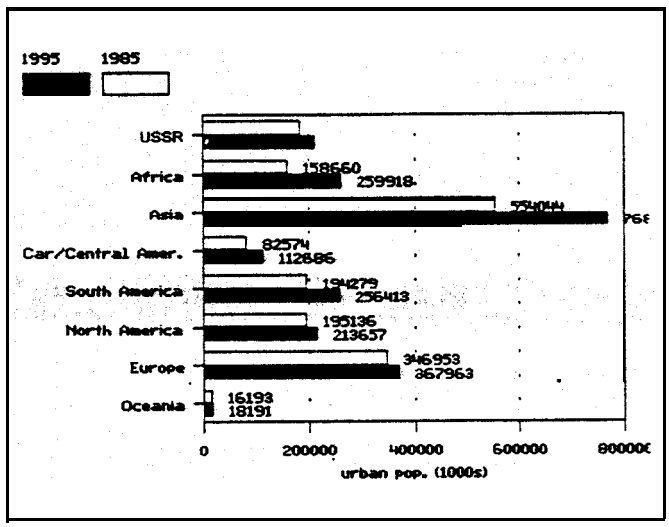

Fig. 1: Regional distribution of urban population 19851995. *(Source: The Prospects of World Urbanization: Revised as of 1984-85, New York,* United Nations, 1998).

The challenge of sustainable urban development

The 21st century will pose the sustainable development challenge to a predominantly urban world.

Global urban population is projected to increase by 1.2 billion between 1980 and 2000. By the year 2025, there could be up to 4.7 billion people living in urban areas, nearly 3 billion more than in 1980. In 192O, only 14 percent,.. of the world's population lived in urban areas. By 1950, the proportion had reached 25 percent and by 1980 stood at 40 percent. This figure is expected to reach 50 percent by the turn of this century and 80 percent by 2025.[1] The bulk of this growth will take place in the Third World where cities are growing three times faster than urban settlements in the richer countries (fig. 1). Ninety percent of the additional urban population for the period 1980-2025 will be located in cities of the Third World.

The impact of such urban growth on the natural environment is, and will continue to be, far-reaching. Patterns of urban development followed in the so-called "developed" countries of the North over the last few centuries are not likely to be sustained in the Third World. Intensive resource consumption and *laissez-faire* **disposal of waste have characterized urban development in countries such as Canada for many generatlons. Reactive measures are belatedly being undertaken but the urban development paradigms that have caused the depletion of resources and pollution of natural environments in the North — and, indeed, globally — are being replicated in many Third World cities.**

The effective and efficient operation of cities is essential to economic, technological, social, cultural and political development in the Third World. New, perhaps radical, approaches are needed to ensure that the natural environment at local, regional, national and global scales can be conserved, restored, protected and left as a legacy for future, largely urban, generations.

Human settlements: Engines of development

The dynamic Innovation generated by cities and metropolitan areas throughout the world is fundamental to a development process without which the economies and societies of most countries would not survive.

It has become increasingly clear that urbanization is one of the single most important developmental processes occurring in most of the poorer countries today. There is little doubt that cities and towns are going to be the focal points for sustained national development or, if

allowed to atrophy, dramatic social and economic decline. The International Labour Organisation (ILO) recently estimated that, over the next 35 years, an additional 1.5 billion new jobs must be created to sustain a doubling in size of the urban labor force in the Third World.

In the national economic context, urban centers are veritable incubators of economic activities. Some of these, such as banking and government services are large scale. But the vast majority are small-scale enterprises, ranging from selling snack foods to mending shoes and building houses. The growth of these multiplier activities is the foundation of most domestic economies.

Economic and social progress in the countries of Asia, Africa, and Latin America will depend largely on the development of their urban settlements. Just as in the urbanized world, cities in urbanizing nations must intensify their roles as engines of development and creators of wealth if their people are to survive and develop without the numbing yoke of abject poverty (fig. 2).

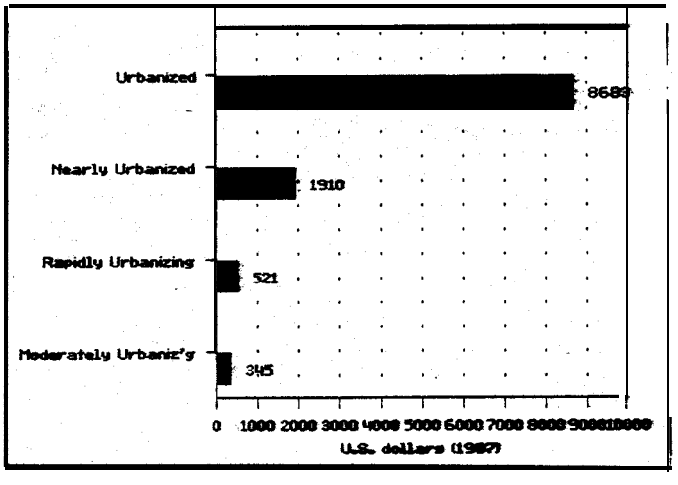

Fig. 2. GNP per capita and urbanization, 1987. *(Source: The Prospects of World Urbanization: Revised as of 1984-85* New York, United Nations, 1988).

Cities are also the centers of technological transformation. New technologies are created and most often are put into practice first in urban centers. As such, cities have a critical role to play as purveyors of technical information, ideas and tools which are so central to increasing productivity, incomes, and ultimately the overall quality of urban and rural life.

But cities are more than economic and technological engines. They are the social, cultural and political sentinels of society. Aside from accessing potential economic opportunities, people stream to cities — and choose to remain, and bear and raise their children in them — because of the plethora of social and cultural services, contacts and opportunities that urban thresholds of population concentration provide. Health care and facilities for the aged, education, recreation, entertainment and the arts are far more accessible in most cities of the world than in rural hinterlands. The concentration of institutions and information in cities represents a multitude of opportunities for social service and security, intellectual development and cultural enrichment.

Social concerns — rooted in poverty — have a particular importance for the sustainability of urban development. The explosive growth of cities such as Mexico City and Lagos indicates immense social needs, in terms of the provision of basic services, and a massive expression of hope by in-migrants that both social and economic aspirations are more likely to be realized in the city. In urbanized countries as well, the city remains the main symbol of aspirations towards human civilization; equity, the provision of basic needs, opportunity and other social considerations are fundamental to the development of the sustainable city.

Cities in the Third World are also centers of both peaceful and violent political change. They are the incubators for critical evaluation of the status quo and new concepts for ensuring social, economic and political equity. They are also the engines for political reform in, among others, the Tiananmen Squares and Sowetos of the world.

However, human settlements will not become engines for social, economic, technological and political development in the Third World if they undermine the capacity of the natural environment to sustain themselves. From a strictly economic perspective, those cities that are eventually forced — in order to survive — to spend heavily on reactive, environmental measures (such as reconstruction of poorly maintained municipal infrastructures or clean-ups of contaminated aquifers and coastal zones) will be diverting scarce resources to the solution of problems that, as we have belatedly learned in the urbanized North, are clearly avoidable. However, those settlements in urbanizing nations of the Third World that plan and guide their operation and growth in a manner that optimizes the consumption of natural resources, and minimizes waste and environmental degradation, will have created the basis for investment in urgently needed social and economic development initiatives.

Sustainable. development

All societies perform four functions with the natural, human, capital and information resources that are required for development:

- they extract or otherwise obtain them;
- they process or otherwise transform them;
- they distribute and allocate the processed resources: and,
- they consume or utilize resources as individuals, families, communities and nations.

Extraction of resources beyond the capacity of the environment to replace them results in resource depletion. Pollution of the environment occurs when methods used in extracting, processing, distributing and consuming resources creates wastes that are discharged into air, land and water. Development itself — be it economic, technological, social or cultural — is not the cause of resource depletion and environmental pollution. The cause is poorly managed development: the methods that society chooses to guide its development are the institutional mechanisms of economic, financial, social and cultural policies, environmental and urban/regional development policies, organizational structures, management systems, and laws and regulations. These institu-

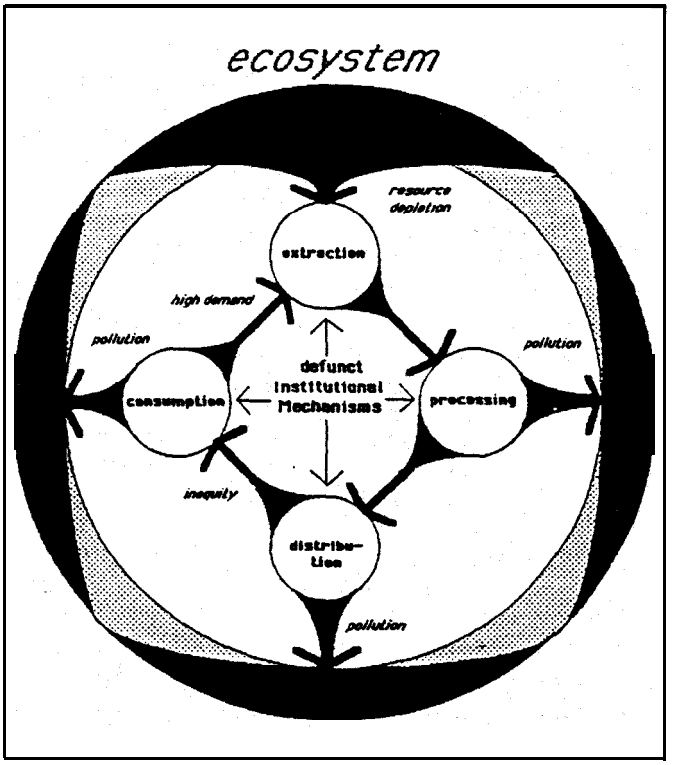

Fig. 3: **Unsustainable development.**

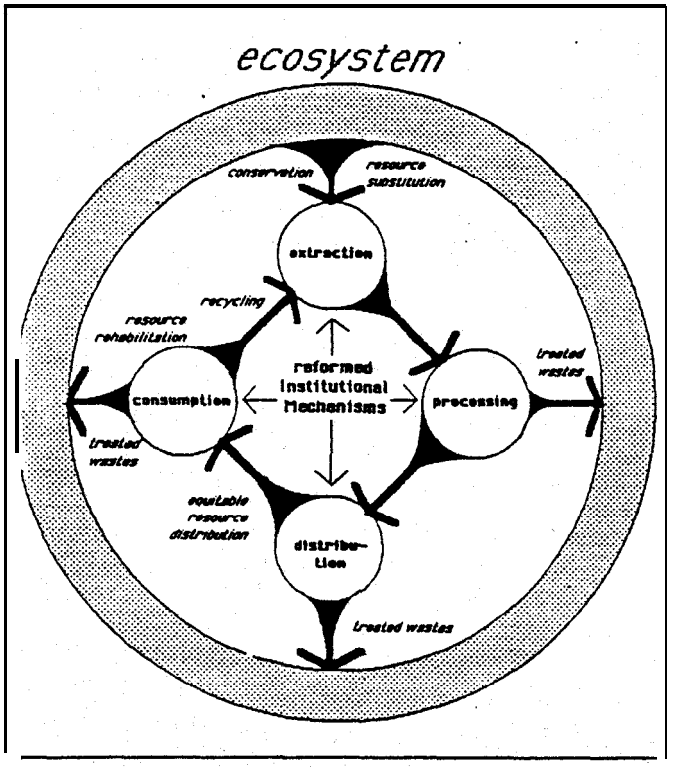

Fig. 4: **Sustainable development.**

tional mechanisms result from a society's system of values that determine its ethics.

Unsustainable development is inequitable development that depletes non-renewable resources, consumes renewable resources at a rate faster than the ecosystem can regenerate them, and undermines the productive and reproductive capacities of the natural environment through pollution (fig. 3).

Sustainable development is the process of equitable economic, social, cultural and technological betterment in a way that does not pollute ecosystems and deplete natural resources (fig. 4). Sustainable development implies the enhancement of human resources, the capabilities of communities to work towards economic, social, technological and cultural enhancement. It is heavily dependent on the attainment of sufficient capital and information resources. Simply addressing the proper management of natural resources without paying equal attention to the strengthening of human, capital and information resources will not, in the end, lead to sustainable development.

Sustainable development cannot occur in any country without carefully taking into account its human settlements. Initiatives cannot be successfully undertaken in ensuring the sustainability of a country's agriculture, forestry, fisheries and industries without addressing the context of the system of human settlements in which they occur. Human settlements are not only cities: with the increase in transactional flows that are occurring between human settlements in the latter part of this century, the historical distinction between urban and rural societies is quickly diminishing: hamlets, villages, towns and cities in urbanizing nations constitute intricate economic, social and regulatory systems that cannot be disaggregated in planning for truly sustainable development.

As policy makers in Third World countries and development assistance agencies begin to grapple with sustainable development, they must carefully take into consideration the roles of human settlements in the extraction, consumption, processing and distribution of natural resources. They must develop strategies for ensuring sustainable urban development.

An urban typology of nations

There is a tradition of viewing the world as a construct of "developed" and "developing" nations. A more precise, urban typology, however, will better inform discussion and action on sustainable urban development. Countries can be classified by the kinds of urban growth they are currently experiencing (fig. 5) in the following four categories:

- Urbanized countries such as Canada, the US, nations of Europe, the East Bloc, and most of South America; these countries no longer need to deal with massive population influxes into urban areas. Rather they are facing issues related to the operation, maintenance and rehabilitation of urban services and infrastructures. How they go about doing this will have significant impacts on resource depletion, environmental pollution and health. As an indication of the magnitude of the issues involved, one may note that:
- Canadians are the highest per capita consumers of energy in the world; on a per capita basis, they consume three times more energy than the Japanese and twenty tlmes more than the Chinese; being a highly urbanized society, most of this energy consumption clearly occurs in towns, cities and metropolitan regions[2];
- Of Canada's hazardous industrial waste, 80 percent

is dumped untreated into the aqueous and gaseous environment each year;

. One of every one hundred new-born children in Mexico City suffers from mental deficiencies thought to be caused by air pollution.

● **Nearly urbanized countries** are principally countries in North Africa, the Middle East and parts of Central America; these countries are responding to the challenge of making, over a very short period of time, massive capital and institutional commitments to industrial and urban infrastructures that will set the course for their continued economic, technological, social and cultural development well into the next century. They will also provide the framework through which resource depletion, pollution and their effects on environmental health will occur. A typical example of the type and scale of problems may be given:

- The infant mortality rate in metropolitan Alexandria exceeds that of Egypt as a whole: typhoid, hepatitis and dysentery transmitted through polluted water bodies are endemic.[3]

● **Rapidly urbanizing countries** are most of the countries of Asia and Africa. These nations face a daunting task of compressing centuries of development into a period of two or three generations. They are among the poorest countries in the world yet are facing massive population influxes to cities. The quantitative and qualitative inadequacies of existing urban infrastructures, and the inefficient urban and environmental management systems that generally exist in these countries, are causing severe depletion of land, water and fuelwood resources and serious pollution of water and air. Examples of characteristio problems are:

- The physical size of urban areas in rapidly urbanizing nations is expected to double from 8 million hectares to more than 17 million hectares between 1980 and the year 2000; much of this expansion will be on land currently used for agricultural and forestry **purposes[4];**
- Over-consumption of fresh groundwater in the southern and eastern parts of Bangkok, a rapidly urbanizing metropolis, has led to their sinking by 5 to 10 cm a year (a rate faster than in Venice during its worse period of subsidence) with concomitant impacts on buildings and surface and below-grade **infrastructure[5];**
- The percentage of urban dwellers with access to potable water in Bangladesh, Burma, India, Nepal and Thailand

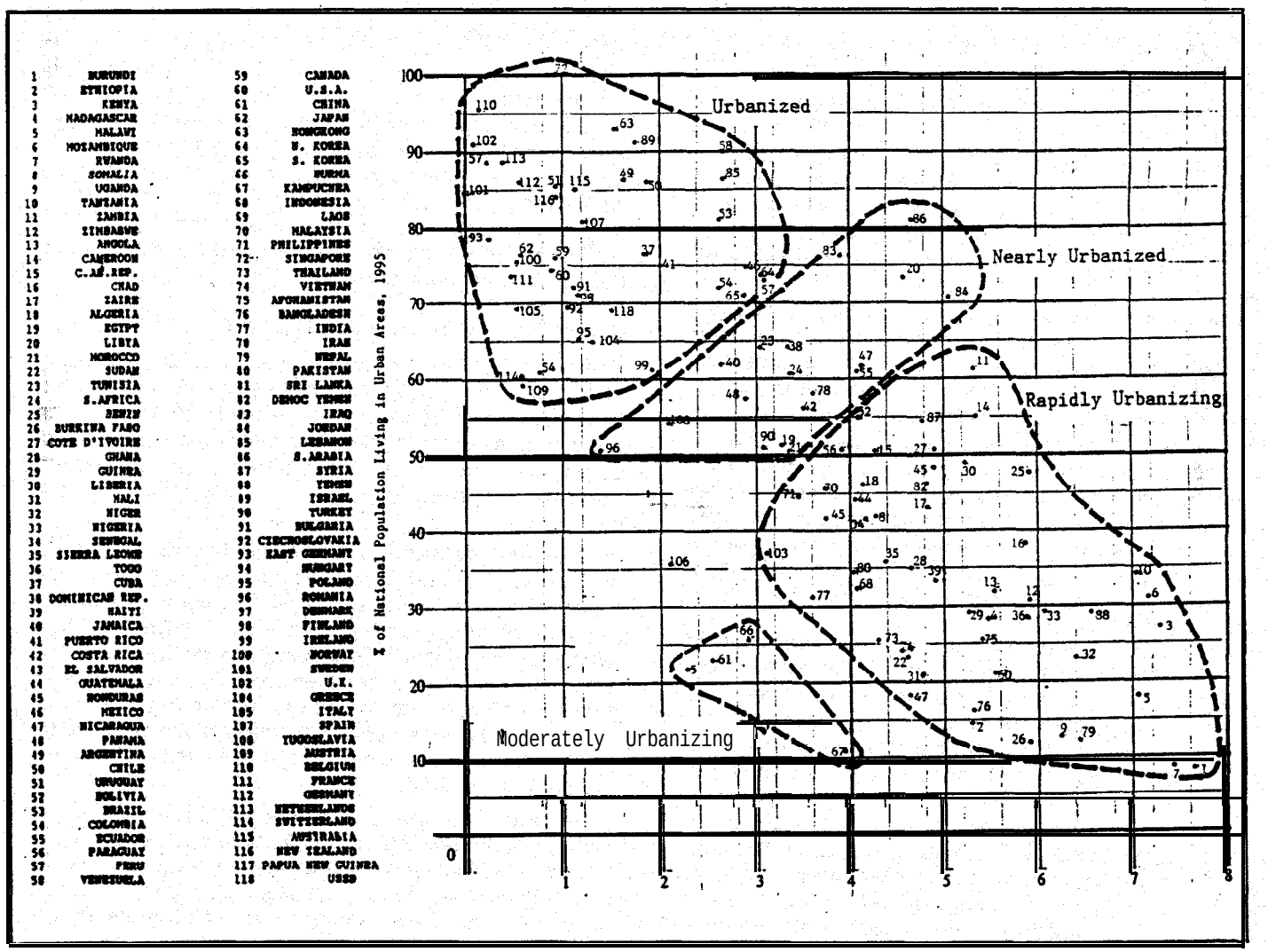

Fig. 5: A matrix showlng clustering of world countries into four types, based on the percentage of natlonal population that is urban, and urban growth rate. *(Source:* ***The Prospects of World Urbanization: Revised as of1984-85,*** New York, United Nations, 1988).

declined between 1980 and 1985 yet rose for their rural **populations[6];**

- Domestic and industrial pollution is wiping out fisheries in areas downstream from Jakarta, Seoul and Manila;
- Air pollution is known to be the cause of 48 percent of all lung cancer and other respiratory **diseases in Manila[7];**
- In Calcutta 60 percent of the population suffers from respiratory diseases caused by air **pollution.[8]**

● Moderately urbanizing countries are the countries of Burma, Kampuchea and Sri Lanka in which urban growth rates are generally quite low. However, China, even though its urban growth rates are not as high as in rapidly urbanizing countries, has an urban population of over 200 million people. Serious environmental problems exist in many Chinese cities:

- Shanghai's Huangpu River and Suzhou Creek are so polluted that they are believed to be the cause of 80 percent of that city's cancer fatalities*;
- The hepatitis epidemic in Shanghai in 1988, that struck 1.2 million residents and claimed the lives of thousands, was caused by untreated sewage contaminating clam beds near the Yangtse **River[10];**
- Lung cancer in urban China is four to seven times the national average — low-grade coal is the major energy source in **China.[11]**

The regional distribution of these four types of countries is shown in figure 6. Each of these fourtypes of nations faces common issues vis-à-vis the natural environment, although priorities for dealing with them vary. But each also faces unique problems and opportunities. Policy makers, therefore, particularly in development assistance agencies, must clearly recognize both the commonalities and the differences in addressing strategies for sustainable urban development.

Types of urban systems

Strategic planning for sustainable urban development will be heavily influenced by the type of urban system being planned for. Strategic considerations - objectives, policies and institutional mechanisms — will therefore need to respond not only to the exigencies posed by the levels of urbanization described above but also to the following forms of human settlement:

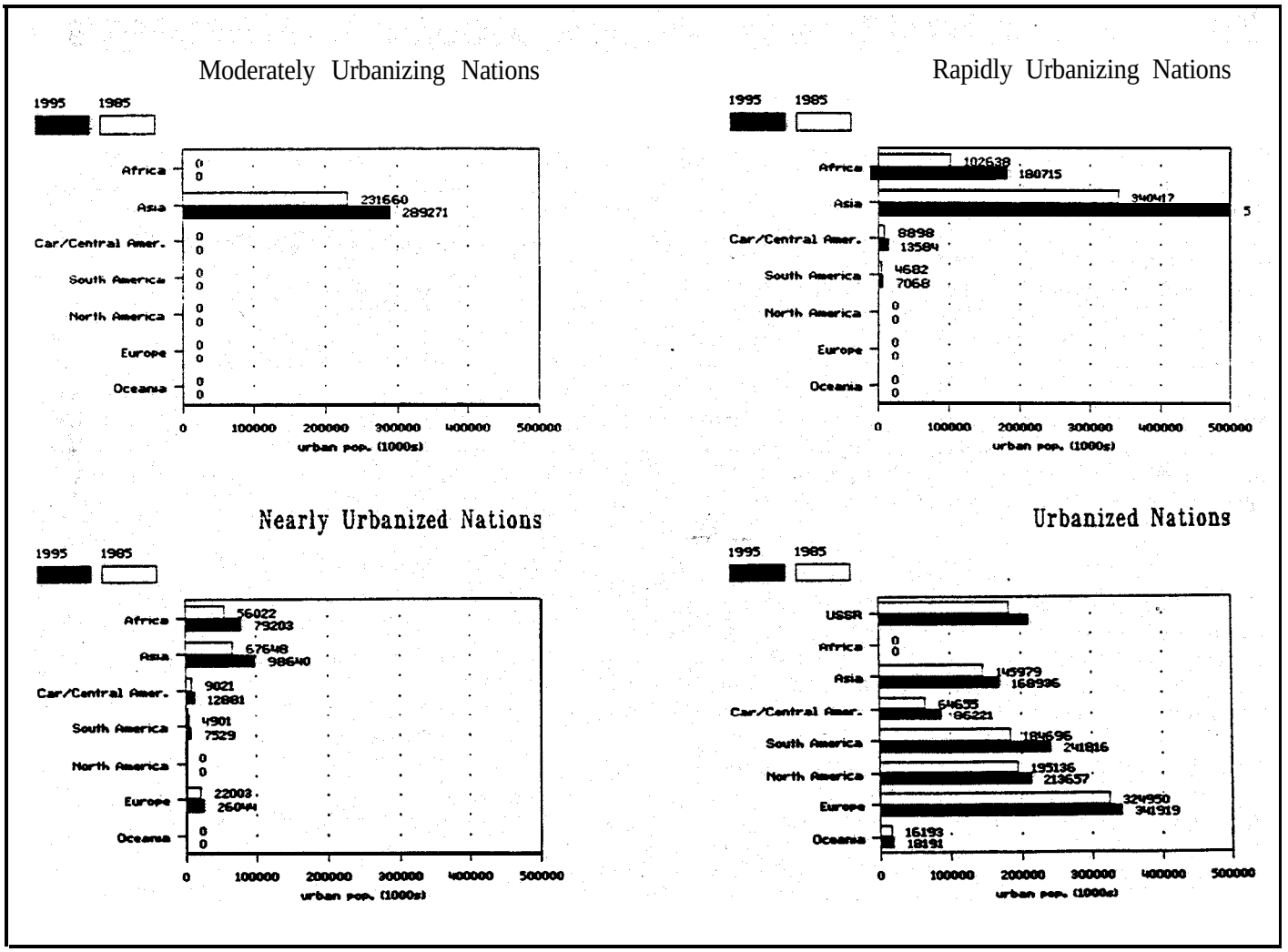

Fig. 6: Regional distribution of urban nation types 1985-1995.
***(Source: The Prospects of World Urbanization: Revised as of 1984-85*, New York, United Nations, 1988).**

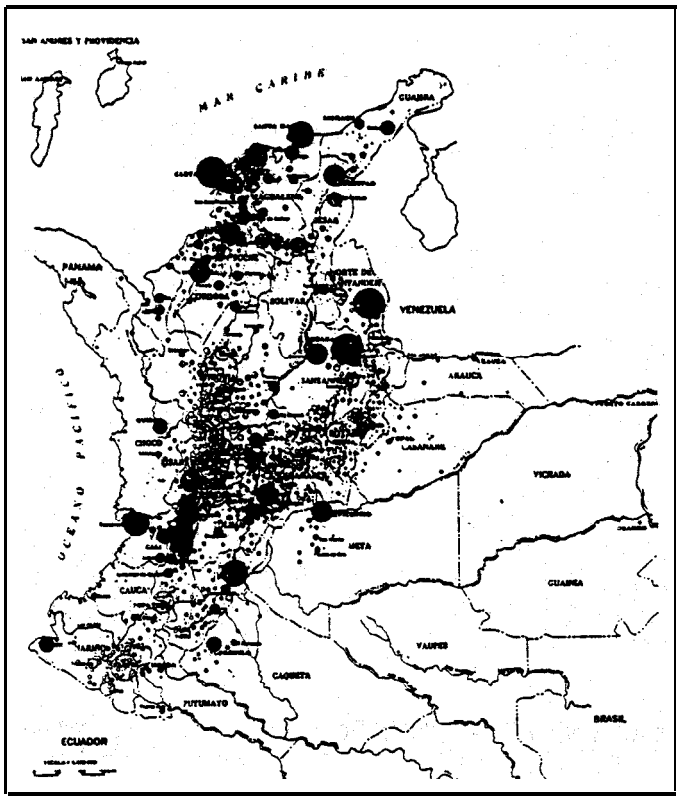

FIg. 7: Network of intermediate and secondary cities in Colombia. (Source:Atlas de Colombia, Bogota, Instituto Geografico "Agustin Cadazzi," 1977).

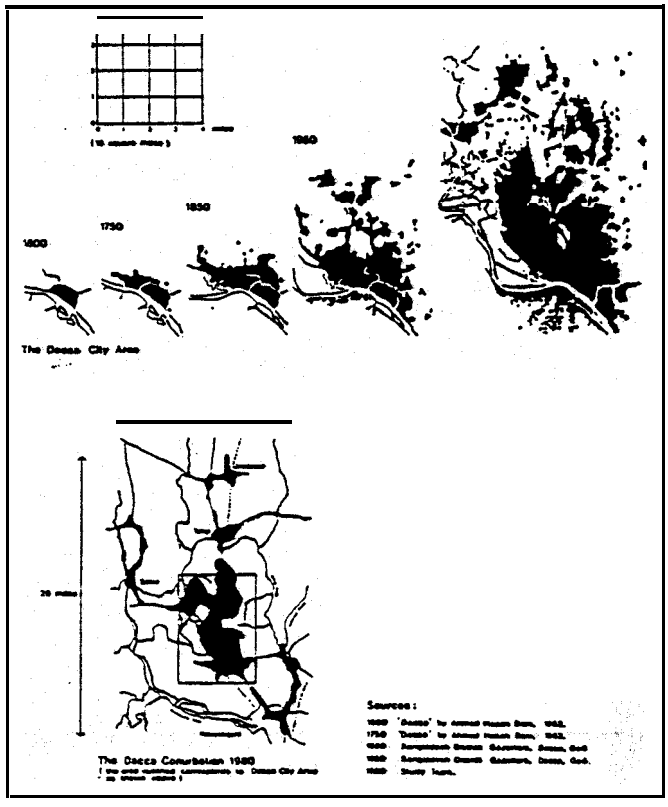

Fig. 8: Growth of built-up area of Dhaka, Bangladesh. (Source: City *Profiles,* Nagoya, United Nations Centre for Regional Development, 1988).

● **intermediate and secondary cities: There is no universal consensus on the size of intermediate and secondary cities. A secondary city** in **Mexico would clearly** correspond to a huge metropolis in Rwanda. However, in 1980 over 80 percent of the urban population in the Third World lived in cities and towns with less than 100,000 inhabitants.[12] The importance of intermediate and secondary cities is largely in their linkage of rural agricultural producers to national and international markets. Characterized by their small size and interconnectedness, these cities are playing increasingly important roles in the implementation of many national policies on agricultural production, productivity and import substitution (fig.7).

● **Metropolitan regions:** These settlements vary in size from 1 million to 20 million people (fig.8). They are characterized by their large size, a mononuclear form, high concentrations of formal and informal economic activity within their boundaries, and widespread poverty.

By the end of this decade, there will be 83 metropolitan regions in nearly urbanized, rapidly urbanizing and moderately urbanizing countries (fig. 9). Most will be in Asia (fig.10).

● **Megalopolis: The** emergence of a new, higher-order form of settlement poses challenges to sustainable development that are not nearly well enough understood. A form of settlement that has recently begun to emerge, both in urbanized and urbanizing nations, is "megalopolis."[13] Unlike "mega-cities" which are huge, mononuclear metropolitan regions, a megalopolis is characterized by comparatively large populatfons ranging from 20 million to 100 million, a band-like urban struc-

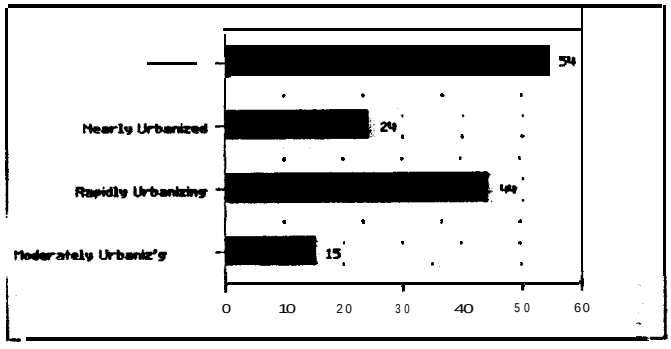

Fig. 9: Number of urban agglomerations with population over 2 million, year 2000 by nation type. *(Source: The Prospects of World Urbanization: Revised as of 1984-45, New* York, United Nations 1989).

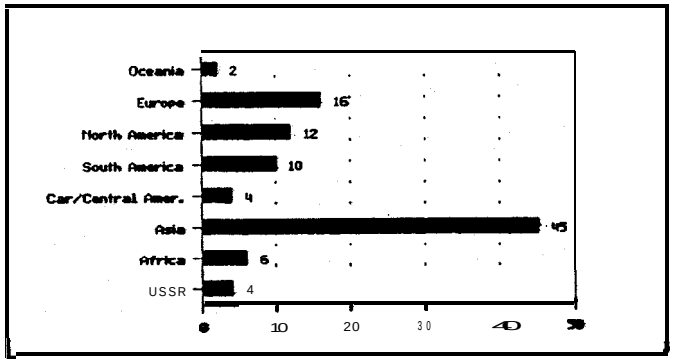

Fig. 10: Number of urban agglomerations with population over 2 million by region, year 2000. *(Source: The Prospects Of World Urbanizatlon: Revised as of 1984-85,* New York, United Nations, 1988).

ture consisting of at least two metropolitan poles surrounded by agricultural land, forests and a closely-linked system of smaller cities and towns, strong connectivity between the poles along a major transportation axis, strong "transactional" economic activity in distribution and services, and a marked tendency to act as an economic, social and technological "gateway" to the outside world (fig.ll).

The impact of this highly complex and dynamic form of human settlement — combining both metropolitan regions and intermediate and secondary cities — on regional and global environments must be taken into account in the formulation of strategies for sustainable urban development in an increasing number of countries, such as China, Indonesia, Bangladesh, Philippines, Pakistan, India and in parts of South America.

Elements of a strategy for sustainable urban development

Each city, metropolis, megalopolis and country will need to develop its own, localized strategy for sustainable urban development that responds to existing environmental conditions,socio-economic systems, and structures of governance. However, there are some key elements that are likely to be generic. The emphasis that countries need to place on these elements, and the measures adopted for their implementation, will vary according to the level of urbanization and form of settlement being planned for.

● **Conservation of non-renewable resources:** There is a plethora of actions that could be undertaken to conserve non-renewable resources in and around the world's cities including:

- setting land use policies that increase densities to conserve land;
- setting policies and establishing comprehensive mass transit programs to reduce the use of automobiles in nearly urbanized and rapidly urbanizing nations;
- regulating the volume of automobile traffic to minimize the consumption of fossil fuels;
- conserving wetlands and coastal zones; and,
- defining or creating wildlife protection areas.

● **Resource substitution:** Non-renewable — and some man-made — resources need to be replaced with those that are renewable (fig.12). The most obvious is replace. ment of fossil-based fuels with other resources in the creation of energy — e.g. aside from solar and wind-powered **energy,** biogas energy as pioneered in **India.**[14] Others include replacement of building products created from non-renewable resources by man-made materials manufactured with zero discharge or by other natural resources — such as in Peru where traditional adobe technology is slowly beginning to replace cement-intensive, masonry **construction**[15] — and replacing chlorofluorocarbons.

Comprehensive directories of locally available, substitutable resources for use at all scales of the urban environment, ranging from the megalopolis to the workplace and the home, need to be formulated.

● **Resource rehabilitation:** The rehabilitation of coastal zones, wetlands, aquifers, forests and wildlife habitats

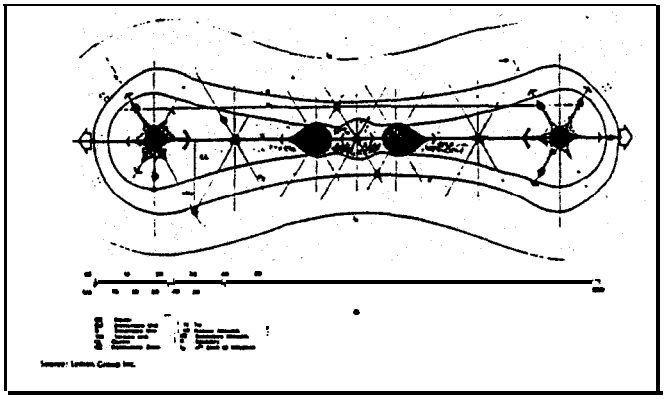

Fig. 11: Megalopolis. (Source: Leman **Group Inc.).**

are all actions that can occur in urban areas and benefit them. Even the creation of urban parks can play a major role: ten deciduous trees absorb about four tonnes of carbon a year, as much as is created by the average Canadian. Reforestation of urban peripheries in Third World countries can, under proper practices ensuring sustainable yield, provide badly needed fuel. It can also drastically reduce erosion and subsequent silting of urban infrastructure(fig.13). Restocking of fish and wildlife can benefit local and regional ecosystems and economies, provide an important source of food in Third World countries, and contribute to export earnings, for example, shrimp farming.

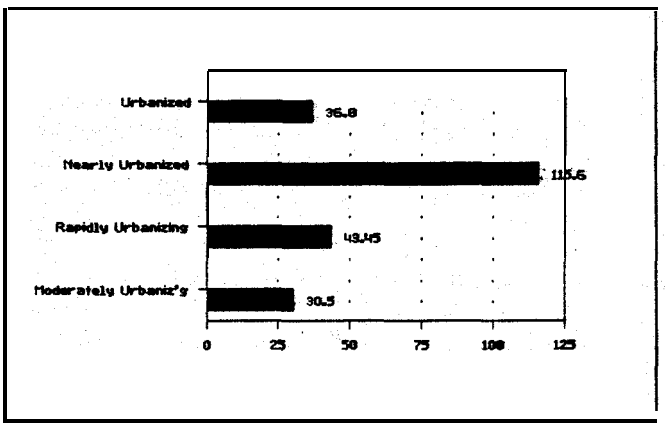

Fig. I2: Percentage change in per capita **energy consumption, by category of country, 1970-1986. (*Source: World Resources 1988-89).6***

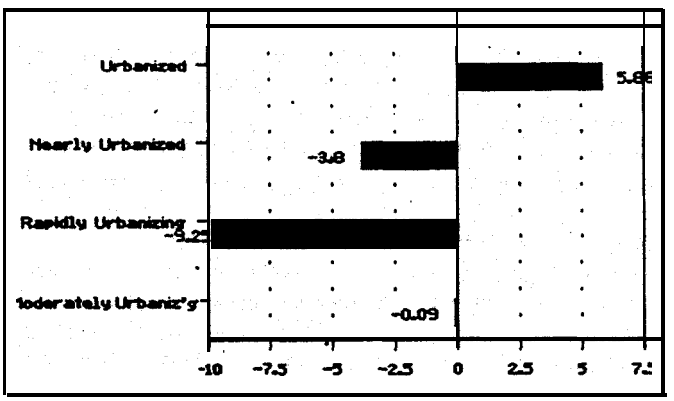

Fig. 13: Percentage change in forests and woodland by category **of country, 1964-1989. *(Source: World Resources 1988-89).6***

- Recycling: Urban recycling must go far beyond the scavenging of garbage dumps if it is to contribute fully to sustainable urban development. Materials long believed to be useless waste are now being found to have a wide range of possible applications. Examples are:
  - use of waste from bauxite mines in brick manufacturing, as in the case of **Jamaica**[16];
  - substituting energy-intensive cement with ash from combustion of rice husks and blast furnace slag, as applied in **Brazil**[17];
  - replacement of cement in concrete with fly-ash a by-product of pulverized coal combustion in thermal power plants, as in **Argentina**[18]; and,
  - use of natural pozzolans to replace cement, as in **Guatemala.**[19]

  Recycling implies efficiency and innovation, prerequisites to sustainable urban development.

- **Control and treatment of waste emissions:** Technological advances over the last few decades have provided many cost-effective ways of controlling and treating a wide range of gaseous and aqueous emissions in the urban environment. Aside from automobile emission controls and smokestack technologies, domestlc and industrial sewage treatment systems are fast becoming essential elements of urban infrastructures, at least in many urbanized countries. However, most cities in urbanizing countries lag seriously behind in the introduction of systems and technologies to control and treat waste. For example, Shanghai's Huangpu River is so polluted that, in some stretches, it is anaerobic for 150 days of the year; 80 percent wastewater pollution is of industrial origin and consists of high concentrations of arsenic, mercury, phenol, chromium, lead and zinc.[2°] Even though Shanghai's Environmental Protection Bureau attempts to regulate industrial waste emissions and many factories have installed source treatment technologies, these systems are routinely turned off after EPB inspections in order to reduce energy costs.[21] Waste control and treatment is more than simply a technological task. It is a function of economic, political and institutional factors as well.

- **Management of non-recyclable waste:** Some wastes are clearly non-recyclable. Special management regimes are required for many toxics and radioactive materials. Most of these wastes have urban origins. Technologies are becoming available to safely contain these non-recylable wastes but serious problems remain concerning affordability, the location of dump sites in urban regions and in their management. Even if environment/economic regimes are put into place that drastically reduce the creation of non-recyclable wastes, there will always be a continuing need to provide for the containment of some toxic and radioactlve materials.

- Resource distrlbution: There are two aspects of resource distribution that require careful attentlon in any strategy for sustainable urban development:
  - The first aspect relates to the belief in many quarters that the distribution of resources should be focused on rural areas in the Third World. This contentlon is based on the perception that "cities are bad" and "drain the countryside," i.e. if more attentlon was paid to distributing needed resources to rural areas, urban growth would not occur. However, people move to cities not only to seek economic gain but also for social, cultural and political reasons. In many Third World cities up to 60 percent of urban population growth is generated internally.[22] The debate over rural/urban resource dlstributlon is quickly becoming superfluous.

  *The second important aspect that must be addressed is resource distribution within urban areas: the spread between the rich and the poor in all Third World cities. Reforms of socio-economic regimes that constrain the poor from gaining access to resources need to be the cornerstones of **a** sustainable urban development strategy. Clearly, equitable distribution of resources is a fundamental element of the sustainable development equation both globally and within cities, be they in urbanized or urbanizing nations.

Institutional change

No matter how strong a commitment to sustainable urban development, or how effectively a technology can potentially deal with pollution, without institutional changes in the development and management of cities and the natural environment, sustainable urban development will not occur. There are a broad range of institutional mechanisms that need to be addressed, including policies and operations.

Policies

- Policies and practices in the urbanized North that encourage resource depletion and pollution in Third World countries through unequal trade practices and capricious consumption of commodities and low-cost manufactured goods;
- Fiscal and monetary measures, such as taxation policies, that provide economic incentives to deplete non-renewable resources and to pollute;
- Socio-economic policies that preclude equitable distribution of resources, particularly to the urban poor;
- Urban development policies promulgated since the 1950s — and transposed to many Third World countries — that are based on principles of maximum consumption of unlimited resources of land, water and fossil-based fuels;
- Investment strategies based on minimizing initial capital costs as opposed to optimizing long-term,life-cycle costs; and,
- Policies that preclude urban governments from generating sufficient revenue, or recovering their costs, in the provision of urban services and ongoing management of municipal infrastructures.

Operations

- Regulatory measures, that are insufficient in scope, are not easily enforceable and do not provide for sufficient public scrutiny;
- Organizational mandates and designs **in government** and industry that preclude consultation, vertical and horizontal integration, and public accountability;
- Governing structures that centralize economic and, where it formally exists, environmental decision making away from local communities: and,
- Insufficient and/or inadequately trained technical, professional and managerial personnel to manage urban

development and the natural environment.

to be made to provide for the implementation of a sustainable urban development strategy will clearly be infiuenced by the form of settlement and the level of **urbanization** that a country has reached.

Effective institutional changes in ail countries, urbanized and urbanizing alike, will be the cornerstones of sustainable urban development. Without them, prociamations on sustainable development will be empty rhetoric that do little to improve the quality of life for future, largely urban, generations.

References

1. Statistics from United Nations Centre for Human Settlements, *Global Report on Human Settlements, 1986* (New York, Oxford University Press, 1987), pp. 18-32.
2. World Bank, *World Development Report 1989 (New* York, Oxford University Press), Table 5: Commercial Energy.
3. Ahmed Hamza, "An appraisal of environmental consequences of urban development in Alexandria, Egypt," *Environment and Urbanization*, vol. 1, no. 1 (April 1989), p. 24.
4. United Nations Centre for Human Settlements (Habitat), *op. cit.,* p. 130.
5. United Nations, *Population Growth and Policies in* Mega-*Cities: Bangkok,* ST/ESA/ERA/SER.R/72 (New York, UN, 1987), p. 30.
6. World Resources Institute, International Institute for Environment and Development, United Nations Environment Programme, *World Resources 1988-89* (New York, Basic Books), Table 15.4.
7. Rosario D. Jimenez and Sister Aida Velasquez, "Metropolitan Manila: A framework for its sustained development," *Environment and Urbanization*, vol. 1, no. 1 (April 1989), p. 55.
8. World Commission on Environment and Development, *Our Common Future* (Oxford, Oxford University Press, 1987), p. 240.
9. Personal communication to E. Leman from engineer with Environmental Protection Bureau, Shanghai, 1989.
10. Various issues of *China Daily* read by E. Leman during visit to Shanghai, July 1988.
11. World Commission on Environment and Development, *op. cit.,* p. 240.
12. United Nations Centre for Human Settlements (Habitat), *op. cit.,* p. 66.
13. A recent paper on the emergence of megalopolis in Asia is T.G. McGee, "Urbanisasi or Kotadesasi? The emergence of new regions of economic interaction in Asia" (Honolulu, East-West Center, 1987).
14. Royal Architectural institute of Canada, "Biogas energy program, India" in *Canadian Contributions: Case Histories of Shelter-Related initiatives Relevant to Developing Countries* (Ottawa, RAIC, 1987), Section 3.10 (prepared for the RAIC by Chreod International for IYSH).
15. *Ibid.,* Section 6.16, "Seismic-resistance adobe housing, Peru."
16. *Ibid.,* Section 5.6, "Bricks from bauxite waste, Jamaica."
17. *Ibid.,* Section 6.17, "Fiber-reinforced cement substitutes, Brazil."
18. *Ibid.,* Section 6.18, "Fly ash concrete research, Argentina."
19. *Ibid.,* Section 6.19, "Natural pozzolans for masonry, Guatemala."
20. Weng Zhi-xiang, "The improvement of urban environments in metropolitan Shanghai" (Nagoya, paper presented at United Nations Centre for Regional Development international Conference on Metropolitan Morphosis and Development, 1988).
21. Personal communication to E. Leman from engineer in Shanghai's Environmental Protection Bureau.
22. United Nations Centre for Human Settlements (Habitat), *op. cit.,* p. 65.