Urban and Regional Development Paper Series

2002 No.2

A Framework for the Analysis of Urban Sustainability

Linking Theory and Practice

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Cetakan Ketiga

Published by
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PREFACE

This occasional paper is intended to stimulate discussions and generate practical considerations on the importance of the many dimensions of urban environmental sustainability. Parts of this paper have appeared in one of the chapters in the author's doctoral dissertation. However, it has been rewritten to fit with the need of such a framework for the analysis of urban environmental sustainability.

While the content of this paper is the responsibility of the author, the Urban and Regional Development Institute is committed to promote sustainable urban development, especially in Indonesia. It is with this consideration that we publish this paper.

Jakarta, May 2002

The Urban and Regional Development Institute

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INTRODUCTION

It is no longer a question to most people that urban development and management everywhere needs to be made environmentally sustainable. The question has always been "How?" The challenge of creating an environmentally sustainable urban environment is indeed a great one because cities significantly contribute to the many environmental problems we face today and yet they also play influential roles in the improvement of human well-being by facilitating social, cultural and economic development. The challenge is even greater in the face of three major trends that currently affect the way we plan and manage cities: (i) urbanization, with more people living in urbanized areas; (ii) globalization of the world's economies, with more local economies connected to each others; and (iii) decentralization of decision making processes, with more government functions transferred from national to local governments.

While, for practical reason, the question "How?" needs to be responded in a simple manner, there is also a need to look at the real meaning of sustainability and its implications on urban development so that we can be sure that the steps we are taking will lead our cities toward sustainability. Before we can answer the question of how to make urban development more sustainable, we certainly need to know how sustainable our cities are. And before we can answer this question, we need to understand what sustainability really means.

Hence there is a need for something that can link the theory of sustainability and the practice of sustainable development at the local level. There are several possible linkages such as various kinds of practical guidelines,[1] tools for urban environmental planning and management[2] or an indicators and other "analytical tool" that can be used as a framework in evaluating the environmental sustainability – or unsustainability – of an urban region. This study is basically an attempt to provide one possible framework for such an analysis. The results of this analysis can then be used as considerations in planning and management of the urban region.

This kind of endeavor, however, has to avoid the pitfall of "reinventing the wheel" since there has already been a growing mountain of published works on the attempts to understand sustainability as well as on the successful practices of sustainable development at various levels (global, national, regional, local and community). At the practical level, there have been various real efforts – many of which have been at the local or community levels – to actually implement some "components" of

sustainable development such as those that have been considered as "best practices."

However, if we look at most of what have been done so far more critically, one cannot avoid posing a question whether all of these real actions on the fields would really lead our cities to environmental sustainability or they are just a collection of good things for the citizens and the environment within the cities without any consideration of the impacts of urban processes in these cities on people living outside or faraway environment. We will only know if we understand what is meant by sustainable urban conditions or processes. And for this, the knowledge is already there for us to pick.

While it is impossible to examine all publications on theories and cases related to sustainable development, this study has attempted to include some major highlights in the evolution of ideas that resulted in sustainable development – and its "derivative" idea of sustainable urban development – as well as the debates it has generated and the problems in its implementation. A clear taxonomy of the debates at both the macro level (on the idea of sustainable development) and the micro or urban level (on the idea of sustainable cities) is important to be revisited in order to really understand the issue of sustainability. This study then affects the proposed framework for an urban environmental sustainability analysis.

Considering the wide array of issues that have been discussed in the existing literature, this study emphasizes on one characteristic of sustainable development that has rarely been emphasized elsewhere: its multidimensionality. The highlights of the history of sustainable development are included only to support the multidimensionality of the concept. The main message here is that sustainable development should not only cover temporal or inter-generational dimension but also spatial, socio-economic, political, inter-species and inter-medium dimensions. While some of these dimensions have been widely discussed elsewhere in the literature, the spatial dimension has been particularly and dangerously overlooked in many efforts to understand and implement sustainable urban development.[3] This proposed framework has therefore been formulated to accommodate these six dimensions of urban sustainability.

With the above-mentioned objective and background in mind, this study is presented in three parts. Part One provides the macro-level theoretical base for the framework. As such, it needs to briefly revisit the root of modernism – the idea of progress – and the ensuing environment-development debate that eventually lead to the emergence of the idea of sustainable development. It is also necessary to include some of the critiques of the concept. Critiques are needed if the concept of sustainable development is to be gradually improved for time to time.

Meanwhile, Part Two provides the micro or urban level theoretical base. It briefly looks into the roles of cities and city planning in the environment-development debate and examines the rapidly emerging efforts to conceptualize, interpret and implement the idea of sustainable cities.

Finally, Part Three illustrates the proposed framework that can be used as an approach in analyzing urban environmental sustainability. It bases primarily on the definitions and dimensions of sustainability that are discussed in the first two parts. However, the selection of indicators to be used in the evaluation is dependent upon the particular context of the case studied and on how the indicators are viewed by the stakeholders/actors in the particular case. Participation of all stakeholders in any evaluation of an urban region's sustainability is critically necessary in applying this framework. Yet it will need several "trial-runs" of this framework to make it a more applicable tool of analysis. Moreover, to make this tool of analysis useful, it has to be followed up by proper planning and real actions; otherwise it will remain an academic exercise.

Notes:

[1] See Knowles, et.al. 1999, for example.
[2] See Leitmann 1999, for example.
[3] As we shall see later, the most widely used definition of sustainable development – the Brundtland Report's – also contributes to the inattention to the spatial dimension of sustainability in many discussions and actions to implement the idea of sustainable development.

Part One: Macro Level Theoretical Base
UNDERSTANDING SUSTAINABLE DEVELOPMENT AND THE ROOTS OF THE IDEA

Is there really a global environmental crisis? If there is, is the idea or practice of development mainly to blame? Environmentalists, some scientists and many other people from various disciplines would say so.[1] On the other hand, in a no smaller number, there are others who strongly disagree. There are also those who would dispute the causes, the consequences, the seriousness of the crisis, the necessary or appropriate responses, as well as the role of development in any environmental problem. These themes have dominated the continuing environment-development debate, even long after the idea of sustainable development was introduced.

Before summarizing the environment-development debate, this study needs to briefly look into the origins and the various strands of thought within each side of the debate. After all, the two sides of the debate are not homogeneous and the differences within each side certainly influence the debate. Moreover, although it is presented here in a debate format, the environment-development discourse has never been as simple as the review may indicate. This revisit of the debate as well as the history of the concept is need to help explain the multidimensionality of sustainable development.

The Roots, Theories and Practices of Development

One of the main roots of development – and indeed, of modernism – is the idea of progress (Norgaard 1994; Roth 1993; Wilkinson 1973), which has often been dubbed as a "secular religion" (Lasch 1991, as quoted in Roth 1993:36). Emerged in Western Europe in the sixteenth century – and as articulated by philosophers Adam Ferguson, Saint-Pierre, Turgot, de Condorcet and the like (Roth 1993) – this belief propounds the idea of endlessly improving humanity through accumulation of material well-being, advancement of sciences and technology, control over nature, rational social organization and other changes that can be seen as a betterment of human's life.[2] In other words, the idea of progress idolizes those who push "the limits of human possibility" (Maser 1999:18). This belief has become the core of the modern way of thinking at the personal and institutional levels. It is basically the core of modernism.

With such a promise of human advancement, this belief in progress indirectly or directly stimulated the Industrial Revolution in Europe and the United States in the nineteenth century. Yet the idea of progress also triggered centuries of Western domination over most of the rest of the world through colonization. Ever since, the Western world--followed by Japan, which subsequently adopted the same idea of progress from the West--has put itself in a position of economic and technological advantage or domination.

The idea of progress had also justified the Westerners to expand the geographical domain of modernity by directly helping or indirectly inviting people of other cultures to join modernism and to progress beyond their "backwardness" (Norgaard 1994). At the same time, for many people in the developing world, the affluent life in the developed world has generally been seen as the model of "the good life" (Mies 1986:55). Hence, it attracts the less-developed countries to follow the path of progress of the developed countries, although some developing countries see it--rightly or wrongly--as the only way to survive in this ever-globalizing world economy or to liberate themselves from economic domination by those who have earlier adopted the idea of progress. As a result, at present, the rhetoric of progress is generally much louder in the developing world than it is in the industrialized one.

Development is a progress with plans, patterns and design oriented toward a "positive" direction (Roth 1993). Although development actually involves political, social and cultural transformation (Barrow 1995), most theories and the practice of development seem to have been dominated by economic factors (i.e. economic growth or the efforts to endlessly expand the economies).

Although macro-economic theory is more than two centuries old--if it started with the work of François Quesnay, Adam Smith and the like--development theory, which has mostly been associated with the developing countries--began with the classic article of Rosenstein-Rodan (1943) which proposed to industrialize the "depressed areas" of Eastern and South-Eastern Europe through a massive financial and technical assistance from the "wealthier West." This is often called the "big push" approach. Then, Rostow (1956) proposed several "natural" stages of development that lead toward a "take-off," after which a country or a region can be seen as developed. Rostow's idea of development stages and "take-off" had prompted the notion of "catching-up development."[3]

In the meantime, the neo-Marxian structuralist analysis of development that was popular in the 1960s, argues that under-developed economies have different structural features than those of the developed ones. Therefore, if they only export primary products or even if they copy the development paths of the already industrialized countries, the former

would remain in the "periphery" while the term of trade would benefit the latter as the "center" (Hunt 1989; Kay 1989 among others). In this regard, Hunt suggested further that "Marx had observed, in order to build, capitalism also destroys" (Hunt 1989:167). Such arguments then became the basis for the dependency critiques, which suggested more self-reliant approaches and cooperation among poor countries. The import-substituting industrialization (ISI) was also among the policies proposed by this theory.

Accordingly, the New International Economic Order was suggested by some developing countries clamoring for an international economic justice. This idea was "a call for an end to inequities of the prevailing system and for an increased transfer of real resources from the rich countries to the poor" (Harrison 1980:26). Then there was the Growth with Redistribution, which was forwarded by The World Bank under Robert McNamara with a belief that the developing countries need both economic growth *and* equal redistribution of growth to truly eradicate poverty. Economic growth alone will only increase the economic gap between the rich and the poor within the country, whereas redistribution alone will only make all the population equally poor.

Next, and still in 1970s, the Basic Needs Approach was initially forwarded by the International Labour Organization (ILO), which argues that the objective of development is to make sure that all members of the population "get all the essential elements for a life of dignity freed from absolute need: adequate food, clothing, shelter, health care, education, employment, and the right to participate in making decisions that affect them" (Harrison 1980:29).

Similarly, the United Nations Childrens' Fund (UNICEF) and the World Health Organization (WHO) developed the Basic Services Approach, which puts the emphasis on providing the essential public services to alleviate poverty. A wide variety of low-cost technologies and approaches (including out-of-school education, self-help settlement, barefoot doctors and technicians, etc.) were explored to enable communities or countries with limited resources to provide the above essential public services. (Harrison 1980:32-36).

Later on – but still in the 1970s – the idea of Participation in Development was promoted by the United Nations to encourage more people's participation throughout the development process. Beside for its own merits, participation is promoted for its educational, political as well as economic benefits (Harrison 1980:36-38).

Then, the United Nations Environmental Programme (UNEP) and others promoted the Eco-development approach, which suggests conservation of resources by using renewables whenever possible, minimizing wastes,

maximizing recycling, respecting local social and cultural patterns which tend to be more ecologically friendly than the modern culture is (Harrison 1980; Riddel 1981). It recognizes the existence of ecological limits and the need for environmental compatibility (Glaeser 1984).

As the field of environmental-economics began to emerge, the economist Herman Daly (1977) proposes Steady-State Economics, which envisions "an economy with constant stocks of people and artifacts, maintained at some desired, sufficient levels by low rates of maintenance 'throughput'" (17). These latest two development approaches mentioned above, and several other variations, may be seen as the early forms of the Sustainable Development we discuss later.[4]

While the 1970's was characterized by progressive or radical ideas of "development with a human face" with the governments playing a strong role in distributing the economic wealth, the 1980's saw totally different development approaches, which were more market-oriented. This drastic change was seen as a combination of responses to the debt crisis in the late 1970's and early 1980's, to the growing skepticism towards the Keynesian theory--which failed to explain the widespread "stagflation" phenomenon at that time--and to the emergence of the widely discussed Newly Industrializing Countries such as South Korea, Singapore, Taiwan, and Hong Kong. The response to the first and second phenomena was in the form of the Structural Adjustment Approach, promoted by most international lending agencies, whereas the third phenomenon had prompted the idea of Export-Oriented Industrialization.

These later approaches have shown some significant results in economic terms with many of those countries reported rapid economic growth and decreasing poverty. However, there have been some unaccounted social, political and ecological costs to this economic success (e.g. Bello, Kinley & Elinson 1982; Bello & Rosenfeld 1990), which in most cases were not reflected in the conventional economic indicators but actually had made the economic success a fragile phenomenon. The 1997-98 economic crises in some Asian countries could be seen as most vivid demonstration of how fragile this development approach was. The unprecedented economic crisis reminded us that development could not only base on economic considerations but should also include social, cultural, political, legal and institutional aspects of development. The application of good governance has become a necessity in development.

While the development strategies above had been mostly directed to the developing countries,[5] development (in the forms of the pursuit of economic growth, increasing consumption, expansion of built-up areas and the like) also exists in the already developed ones, where the idea of progress was originated and also where many negative impacts--to nature as well as to human being--of past development practices have become

widely felt. It is in this context that the environmental movement was born in the developed world and only later spread to the developing one.

Environmental Problems, Movement and Critiques of Development

Despite their good intentions, the afore-said development strategies have also brought about some environmental problems. To simplify this vast and complex set of problems, Lynton Caldwell classifies six aggregated global environmental trends, with which most local environmental problems can be associated: (i) loss of topsoil through erosion and qualitative deterioration; (ii) depletion of fresh water; (iii) contamination of air, water, soil and living things by chemical and radioactive agents (including the atmospheric ozone layer problem); (iv) devegetation through deforestation and causing desertification; (v) destruction of natural habitat; (vi) loss of biological variety and diversity (1990:133-145).

However, the seriousness of these changes, their consequences as well as the appropriate responses are subject to various perceptions, interpretations and debates. Caldwell also categorizes three different perceived causes of the phenomena which significantly affect the environment-development debate: (i) incidental or accidental environmental impairment, which may only need *ad-hoc* correction, clean-up campaigns, or education; (ii) operational impairment resulting from errors in policy, planning, execution, which may be corrected by laws and regulations, reviews of the decision processes, or technology assessment; and (iii) systemic impairment that is "built into" or inherent in the techno-economic systems, capitalist or socialist (1990:70-74).

Meanwhile, Carolyn Merchant categorizes three main ethics that underlie the various ideological positions toward nature. The first is the egocentric (individualism), which is grounded in the self, believing that maximizing individual self-interests is the best way to live.[6] The second is the homocentric ethic (anthropocentrism), which is grounded in the social good, human welfare and social justice.[7] And the third is the ecocentric ethic (ecocentrism), which is grounded in the cosmos or the ecosystems and believing that "the whole environment, including inanimate elements, rocks, and minerals along with animate plants and animals, is assigned intrinsic value" (1992:74-75).[8]

Although concerns about the environmental health as well as what is considered proper relationship between human and the environment are perhaps as old as human civilization itself and existed in most traditional societies--as indicated by many environmentally conscious traditional practices--the modern environmental movement is a relatively recent phenomenon. Yet, because it has grown into a complex web of social and

political movements, this study can only look incomprehensively to some of the highlights.

Early efforts to identify the "undesirable environmental changes in the natural world that resulted from human intervention" can be seen in George Perkins Marsh's 1864 *Man and Nature* (Roth, 1993:14). While the early arguments about the concept of limits to human growth and activities were famously represented by Thomas Malthus' 1890 *Essay on the Principle of Population,* which was the first to indicate the notion of natural limits to human growth. Meanwhile, in *Sand County Almanac*, Aldo Leopold wrote his famous axiom: "A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise" (1949/1966:224-225). This statement may be seen as his interpretation of the concept of sustainability.

Basically, though, the early stage of environmental movement was concentrated on conservation as indicated by the activism of John Muir, the supports of President Theodore Roosevelt, the births of Sierra Club, National Audubon Society, national parks around the country and others. Merchant argues that although this early conservation movement was aimed at protecting wildlife and forest lands from the expansive human development, "its ethic was homocentric, rooted in Gifford Pinchot's utilitarian maxim of the 'greatest good, for the greatest number, for the longest time'" (1992:159).[9]

The understanding that human life is often also negatively affected by the practices of development did not come into the central discourse of the environmental movement until the 1960's. In 1962, Rachel Carson--named "the mother of modern environmental movement" by some environmentalists--wrote the long-celebrated *Silent Spring*, which among others things reveals the ill effects of the use of pesticide. Then in 1972, the United Nation's Conference on Human Environment in Stockholm furthermore helped increasing the public awareness at the international and institutional levels on the environmental problems, including the establishment of UNEP that has helped coordinate many environmental programs at the international level (Jalal 1993).

Also in 1972, the Club of Rome published the *Limits to Growth,* which suggests that "if patterns of resource use, population growth, pollution and capital accumulation and depreciation were not significantly altered, there would be catastrophic consequences on global scale in the foreseeable future" (Meadows et.al., 1972, as cited in Roth, 1993:12). Because of its similarity in the reasoning with that of Malthus, this belief of the supporters of Limit to Growth has been called the neo-Malthusianism. An example of similar notion of natural limits to the growth of human activities can be found in Garret Hardin's essay *The Tragedy of the Commons* (1968, reprinted in Armstrong & Botzler 1993:224-226).

Another alternative in looking at the Earth is not to look at it as a finite resource or a place to live, but as a living planet or as a "physiological system," as suggested by James Lovelock in his 1979 *Gaia: A New Look at Life on Earth.* He offers an hypothesis that "the biosphere is a self-regulating entity with the capacity to keep our planet healthy by controlling the chemical and physical environment" (Caldwell 1990:53). Furthermore, it "provides a unifying interpretation of relationships between inanimate and animate aspects of the Earth" (Caldwell 1990:53). Although this metaphor has gained considerable respect among environmentalists, the Gaia hypothesis faced early skepticism among scientists (Caldwell 1990:53-54) and has been criticized as "being both teleological and tautological" (Merchant 1992:99).

While grass-root environmental activism increased rapidly in the decades of 1960's-70's, and followed by a growing number of environmental regulations that aimed at mitigating the ecological impacts of development, the 1980's witnessed much scientific research to see the types, scales and scopes of the ecological changes and to invite more public or institutional acceptance of some of the claims {i.e. Clark & Munn, eds. 1986, on the systemic approach to various ecological changes; Houghton, Jenkins & Ephraums 19__ on the Inter-governmental Panel on Climate Change (IPCC)'s scientific assessment; Cline 1992, on the economic calculation of global warming}.

From the mid 1980's onward, though, the debate has generally shifted over to the idea of sustainable development – which was popularized by the 1987 Brundtland Report – and the related ecological-economic arguments. And, the 1992 Earth Summit in Rio has helped institutionalized some of the elements of sustainable development into formal international treaties (Rogers 1993). At the same time, there have been some shifts in the environmental policy in the late 1980's and 1990's which can partially be associated with the re-emergence of more market-oriented approaches to development[10] and the growth of ecological-economics. In this regard, Duane observes that one of the five major trends in environmental policy is a shift from control-and-command to incentive-based regulations (1992:27-47).[11]

Some Responses to the Environmental Movement

Because the environmental movement can threaten many people's values, it is no wonder that there have been perhaps as many critiques of environmental movement as the critiques of development. In this regard, the basic arguments against the environmental movement – or in some cases, against the movement's earlier forms – can be categorized as follow:

i. The cornucopians, who view the earth as a very resourceful and see natural resources as too abundant to be depleted in fulfilling human's need. Julian L. Simon (1981; Simon & Kahn 1984; Simon & Myers 1994[12]) is one of the leading figures of this view;
ii. The technological optimists, who deeply believe that science and technology will solve the possible environmental problems in the future as indicated by the failures of many Malthusian predictions in the past (Simon also sometimes uses this argument. On the other hand, in Simon-Myers 1994 debate, Myers argues that history also provides many examples where "future trends" are not the "continuation of past trends");
iii. The free-market defenders--naturally economists – who strongly believe that free markets have a mechanism to "automatically" solve the problems and that good economy means good environment. Intervention to the market will only create inefficiency (e.g. Nordhaus 1990; Norton 1996);
iv. Those who see that the future benefits of economic development (including natural resource extraction) exceed the environmental costs partially because the results are invested in human development and better built environment (a similar assumption is also seen in the second interpretation of sustainable development we will see later);
v. There are also those who challenge the scientificness and therefore the certainty of many environmental forecasts – such as those of global warming and ozone layer depletion – and argue that this uncertainty may not warrant the economic costs of avoiding the forecasted crises (Becker 1991; Kyle 1993; Nordhaus 1990);[13]
vi. Some people think that environmental protection was (and for some, mostly in the developing world, is still) seen as a luxury and therefore in conflict with the priority of the development (as mentioned in Barrow 1995:xi).
vii. There are also people – mostly from the southern part of the "North-South debate" – who argue that because the developed countries had exploited the environment in the past in order to get into the currently advantageous economic position, it is unfair for them to limit the developing countries exploiting the latter's own natural resources. The argument goes further as to say that if the North really insists that the South limits its exploitation of natural resources, then something should be done to make the two worlds more equal economically. It seems that for many people in the South, Kenneth Boulding's notion of "spaceship planet" or, in a slightly different context, Marshall McLuhan's notion of "global village"--though well understood – does not easily get an appreciation without addressing the issues of socio-economic inequality in this "spaceship" or "village."[14]

Of course, there are also ignorants, non-believers, and even those who use, co-opt and abuse the environmental rhetoric for different purposes. These happen even more easily with the notion of sustainable

development because of its openness to various interpretations (Lele 1991).

In a further attempt to analyze these critiques of environmental movement, Caldwell (1990) points to four main reasons for these people to respond – often with hostility – to the environmental movement:

1. it undermines the satisfaction of people in traditional beliefs and behaviors, contradicting the assumption that the world was made for man and hence rejecting the traditional theologies of creation;
2. it threatens certain economic theories, interests, and objectives, especially those placing material growth above most other values;
3. it exposes the short-term expedience that often characterizes politics and personal economic transactions;
4. it accepts, where necessary, authoritative restriction of individual choice and conduct, often substituting politics for market allocation of values (p.93)

Furthermore, in discussing the environment-development debate, it is important to also point out that development is not the causes of environmental problems we face today, although many observers do think that the prevalent economic system and the values it adheres are indeed the most important factors of all. Beside development, there are at least four other interconnected causes that have been indicated by many students of environmental problems: (i) lack of development, as indicated by the increasingly acknowledged linkage between poverty and environmental problems; (ii) rapid population growth, especially in the developing countries; (iii) open-market failures, as illustrated by Hardin's *The Tragedy of the Commons*; and (iv) policy and implementation failures.

The Emergence of the Idea of Sustainable Development

The literature indicates that the debate between development proponents and environmental defenders stems primarily from differences in their world-views. These differences also affect the way people see the idea that natural resources are scarce and there is (or there should be) a limit to growth. World-views can be ideological, cultural, social-economic or simply matters of taste. As shown in the following tables, one way to view these differences is by comparing how development and environment world-views differ when they are framed in the three different ethics on human-environment relationship (as suggested by Merchant) and on how they view the concept of scarcity and limit to growth.

Table 1. Development and Environment World-Views on the Human-Environment Relationship

	Egocentric	Homocentric	Ecocentric
Development	Market-oriented development strategies	"Development with a human face" and some aspects of eco-development strategies	Some aspects of eco-development; otherwise rarely fits
Environment	Incentive-based environmental regulations; "personal use" motives for conservation; otherwise rarely fits	Anthropocentric environmental views; poverty-environment linkages	Ecocentric environmental views (e.g. deep ecologists)

Table 2. Development and Environment World-Views on the Concept of Scarcity and Limits

	The Concept of Natural Resource Scarcity	The Concept of Human Limits to Growth
Development	Cornucopianism (believe in resource abundance)	Technological-optimism (believe in human ability to solve problems through science and technology); Possibilism (believe in no limit)
Environment	Many natural resources are finite and should be used wisely or protected	There are (or should be) limits

The above summary tables indicate that finding common grounds between development needs and environmental concerns is indeed difficult, especially outside the homocentric view. However, as indicated by the first table, there is an area – the homocentric view – where development objectives meet with environmental concerns. In this matter, Peter Bartelmus contends that "...the overall goals of environment and development are not in conflict but are indeed the same, namely the improvement of the human quality of life or welfare for present and future

generations" (1986:13-14). The concept of sustainable development was then proposed as an attempt to combine the urgent need for development and the importance of protecting the environment.

In the past couple of decades, the term "sustainable development" has become a "catchword" or often a "cliché" not only in the realm of economic development but also in many other aspects of human activities. Although the idea can perhaps be traced back to the metaphor of a limited "spaceship earth" as suggested by the economist Kenneth Boulding's article *The Economics of Coming Spaceship Earth* as well as by Barbara Ward's publication as the same year of the *Spaceship Earth*,[15] it was not until the publication of the World Commission on Environment and Development (WCED)'s report *Our Common Future* — popularly known as the Brundtland Report — in 1987 that the idea of merging environmental concerns and economic development became popular.[16]

The 1992 "Earth Summit" in Rio de Janeiro and several other international conferences organized by related United Nations' agencies or other international organizations furthermore formalized the concept of sustainable development by putting some of its elements into international treaties and plans of actions. Throughout the 1990s, many countries and localities have officially begun adopting the concept of sustainable development in their development agendas, even though the actual impacts of such practices or actions on the environmental sustainability in these countries or localities remain to be seen.

Understanding Sustainability

Before we go further in discussing "sustainable development," it may be helpful to briefly review what "sustainability" really means. The best description of sustainability is perhaps that of Holdren, Daily and Ehrlich: "a sustainable process or condition is one that can be maintained indefinitely without progressive diminution of valued qualities inside and outside the system where the process operates or the condition prevails" (1992:1).

Another way to explain "sustainability" is through an example of what is "not sustainable." Overfishing--or catching more fish than the ability of the ecosystem to reproduce fish--overgrazing or excess logging are examples of unsustainable practices "because we cannot continue doing it forever" (Sustainable Seattle 1995:1).

As it appears, the term sustainability itself is originally used in the context of renewable resources (such as fisheries and forestry) or other non-urban resource utilization (such as agriculture and water resource management) in which the amount and rate of utilization do not exceed the ability of the

ecosystem to reproduce or do not undermine the natural resource base (Brown et.al. 1987; Fresco & Kroonenberg 1992; Lele 1991; Platt, Rowntree & Muick 1994; Toman 1992). However, because the current modes of human activities have been relying on both renewable as well as non-renewable resources, and because there are more and more urbanized areas, the term "sustainability" in the context of sustainable development has to deal with the utilization of non-renewable resources and urban contexts. This is where the attempt to use the concept of sustainability in a wider area of human activities becomes more difficult.

Another difficulty comes from the concept's multi-dimensionality. Combining the analyses of Dryzek (1987), Fresco & Kroonenberg (1992), IUCN (1991); Roth (1993) and others, we can identify at least six dimensions of sustainability: **temporal/inter-generational** (nuclear energy seems to be a cleaner alternative now, but its waste can be a big problem in the future), **spatial** (problem in one place can be moved to another place, such as in the case of transferring waste/pollution from urban to rural areas or from the developed to the developing countries), **social-economic** (transferring environmental costs from one social-economic group to another), **political** (transferring ecological costs from the politically advantaged to the disadvantaged group)), **inter-species** (improvement in human well-being may endanger the livelihood of other species), **inter-medium** (reducing solid waste through incinerator creates air pollution),

Another key question is regarding to the object of sustainability: what is to be sustained? A mere human survival (Hanson 1989) certainly needs different requirements than a continuous improvement of human's quality of life (Meier 1994, among others) does. And still, both goals are homocentric which certainly are different than those that are grounded in an ecocentric ethic, such as a continuous existence of all living beings. This later proposition, though, may be paradoxically unnatural because nature itself sometimes disrupts or puts to an end the life of one or more components of an ecosystem.

There are also at least two broad categories of interpretations of sustainable development that are based on the understanding of what is to be sustained.[17] The first interpretation is represented by Constanza, who argues that "a minimum necessary condition for a sustainability is the maintenance of the total natural capital stock at or above the current level" (1991, as quoted in Holdren, Daily & Ehrlich 1992:6). Such an understanding leads to one definition of a sustainable society by Coomer: "sustainable society is one that lives within the self perpetuating limits of the environments" (1979:1). Ecocentric environmentalists are certainly in favor of this interpretation.

The second interpretation is the mainstream sustainable development, as represented by Serageldin and Steer (1994) contend that there are at least four types of capital stock: natural capital stock (the stock that nature provides), human-made capital stock (investment, as argued by economists), human capital stock (human as a resource itself) and social capital stock (social organization as a resource). They go further to argue for the sustainability of the overall capital stock, allowing substitution from one form to another. For them, a certain level of environmental degradation and natural resources depletion is acceptable as long as the benefits are invested in the improvement of human's quality of life with the same or more value. The problem with this interpretation is how to measure those substituting values.

Being the mainstream, this interpretation of sustainability can be described in many definitions suggested by a large number of authors. For one example, Goodland and Ledec suggest that sustainable development is "...a pattern of social and structural economic transformations (i.e. development) which epitomizes the economic and social benefits available in the present, without jeopardizing the likely potential for similar benefits in the future" (1987:36).

Within this second type of interpretation, there has also been a growing number of ecological-economic analyses attempting to include the values of natural capital stock in the economic indicators used in policy making process. In perhaps the best yet summary of economic analysis of sustainable development concept, Pezzey argues that "economic development could be sustained indefinitely, it was held, but only if development is modified to take into account its ultimate dependence on natural environment" (1992:1).

Meanwhile Barbier proposes that this paradigm should be "...viewed as an interaction among three systems: the biological and resource systems, the economic systems, and the social systems" (1987). Subsequently, many other authors (e.g. Serageldin & Steer 1994; Stren, White & Whitney 1992) have elaborated further this "trilogy" of ecological-economic-social systems. Although certainly making the concept of sustainable development more difficult to carry out, the inclusion of social criteria – such as achieving social equality, reducing poverty, developing strong community solidarity – is indeed necessary, especially but not exclusively in the context of the Developing World. And it is what makes this concept different than the majority of early environmental thinking, and it is also what makes this paradigm more attractive to many in the developing countries.

As the attempt to elucidate the concept of sustainable development continues, there are others who see the need to specify further the objectives or considerations that should be explicitly included in

sustainable development. For example, the United Nations Development Programme suggests that the tenets of development be made of five visions: social justice, ecological sustainability, political participation, economic productivity and cultural vibrancy.[18]

Therefore, it can be argued that the concept of sustainable development – which was initially the result of the environment-development debate – has gradually evolved in terms of what components or considerations are essentials (or what objectives are to be achieved) in sustainable development. While the early formulation of the idea was dominated by economic and environmental objectives, the ensuing discourse has brought about social objectives into the equation. This occurred especially as the result of interactions with the issues of poverty and the needs for development in the less developed world. Further development of the concept brought up the importance of paying attention to political and cultural diversities. Political participation – which has been expanded further into the implementation of good governance, which covers not only participation but also transparency, accountability and the like – is seen as a necessary – although not sufficient – condition for poverty alleviation, environmental protection as well as sustainable development.

The evolution of the concept of sustainable development can be illustrated as follows:

Figure 1. Gradual Transformation of Thoughts on Components of Sustainable Development

Pre Sustainable Development	Sustainable Development		
	Phase-1	Phase-2	Phase-3
Economic Productivity (Growth) as the main objective of development	Economic Productivity and Ecological Sustainability need to be reached and balanced-out in development	Economic Productivity and Ecological Sustainability and Social Justice need to be reached and balanced-out in development	Economic Productivity and Ecological Sustainability and Social Justice and Political Participation and Cultural Vibrancy need to be reached and balanced-out in development

Some Critiques of Sustainable Development

While the idea of sustainable development has become widely accepted by now, it would be incomplete not to include the critiques of sustainable development in this study. Most critiques are based on this concept's "Achilles' heel." The concept's main strength comes from its "all-inclusiveness" which attracts a large number of people from different interests and disciplines – environmentalists and economists alike – and alienates only a few. However, it is also exactly the concept's main weakness. It opens the possibility of co-optation or abuse by those who are insincere and use the rhetoric to mislead public (Lele 1991). Norgaard (1994), Redclift (1984, 1987), Toman (1992), among others, furthermore show the difficulty of putting the idea of sustainable development into operation under the current socio-economic conditions.

Moreover, some people suggest that "sustainable development as an "unanalyzed abstraction" is an excellent device to achieve commitment in the short term, but may lead to tensions or unanticipated consequences in

the longer run" (in Stren, White & Whitney 1992:4). Stren also points to some other people who "reject the idea outright as a virtual oxymoron of two irreconcilable opposite: development (understood to mean more use of natural resources for short run economic benefits) and sustainability (understood to mean respect to biosphere through modification of current pattern of production and living)" (4). And, interestingly enough, such a critique comes from both sides of the debate, the environmentalists as well as the defenders of current development approaches and current economic systems.

Notes:

[1] See for example "Development May Damage Most of the Earth Surface" in *Jakarta Post*, May 24, 2002, which summarizes a report by the United Nations Environment Programme (UNEP).

[2]Following Adam Smith's line, Turgot and de Condorcet believed that free commerce was the best protection against scarcity, and that government intervention only prevented the establishment of efficient commerce and therefore led to scarcity. With the same spirit of progress, Francis Bacon in *New Atlantis* argued that "science and technology were means by which humans could regain the dominion over nature lost when Adam and Eve were expelled from Paradise," while Saint-Simon "predicted that the future society would be an industrial technocracy based on positive knowledge" (Roth 1993:38).

[3]It is also with such an understanding that the terminology of development currently widely used--grouping the countries in the world into such groups of the developed, developing, less-developed and under-developed countries.

[4]The difference between the Steady-State Economics and Eco-Development / Sustainable Development is that the former indicates a non-progressing economy (while still does not exclude some rooms for improvement of the quality of life) while the latter two paradigms still indicate the continuation of progress.

[5] Actually, beside these mostly Western-originated approaches to development, there have been some ideas of development that originated in the non-Western world such as the Gandhian model of self-sufficiency or the egalitarian model of "Pancasila Economics" as proposed by Professor Mubyarto of the Gajah Mada University, Yogyakarta, Indonesia. However, such models of development have not been widely adopted and hardly gone beyond the promoters.

[6]Merchant (1992) refers to the thinking of Thomas Hobbes, John Locke, Adam Smith. I however would question why Merchant also puts Garret Hardin in the same position as she puts the three theorists above plus Thomas Malthus: that their thinking is grounded in egocentric ethic (Merchant 1992:63-70). Looking at the works of Hardin more thoroughly--e.g. his widely known article *The Tragedy of the Commons* (1968, reprinted in Armstrong & Botzler 1993:224-227)--we would come to a different conclusion about Hardin than the one from the reference Merchant makes of this ecologist. In fact, Hardin's message has been that egocentric ethic will lead to a tragedy. It is a rebuttal to the belief that Adam Smith's invisible hand will lead to public good.

[7]Merchant puts the following groups in this category: social ecologists, left Greens, socialists, ecofeminists, many Second and Third World environmentalists, and the mainstream sustainable development movement.

[8]Merchant refers to the thinking of Aldo Leopold, Rachel Carson, Deep Ecologists and the like.

[9]Although the preservationist school – to which John Muir belonged – may better be seen as ecocentric.

[10]Such a transformation toward more market-friendly environments, in the international development discourse, is often associated with the afore-mentioned *Structural Adjustment* Approach.

[11]The other four trends observed by Duane being: (i) the globalization of environmental impacts; (ii) the democratization of pollution sources; (iii) the shift to life-cycle impact analysis; and (iv) the shift from regulating emissions to limiting exposures.

[12]Simon & Myer (1994) is a public debate between the authors' opposing views on the environmental issues.

[13]The attempts to roll-back environmental regulations in the current US Congress may also fall within this category, if not because of some special interests behind the attempts.

[14] As we will see later, it is indeed the inclusion of the concerns over poverty and the resulting need for development – and aspects that were missing in the early environmental movement that was originated in the Western World – that has made the Brundtland Report widely accepted in the Developing World.

[15] Norgaard 1994, 204.

[16] Brundtland Report was certainly not the one that coined the term "sustainable development." Several earlier publications, notably Robert Stivers' 1976 *The Sustainable Society: Ethics and Economic Growth* and the IUCN/UNEP/WWF's 1980 *World Conservation Strategy: Living Resource Conservation for Sustainable Development* had explicitly used the term with similar meanings. It is the report's official status as well as the formulation process which included a solicitation of opinions from various prominent figures in development and environment around the world that has made it the most widely referred to as the early idea.

[17] As mentioned in one World Bank report (World Bank 1994), we may also suggest the third and fourth interpretations, although they are less clear and can be included in the first and second interpretations respectively. The third interpretation here is that of those who suggest that because current level of utilization and its rates of growth have exceeded the natural capacity and because it is too complex to calculate all the trade-off suggested in the second interpretation, why don't we just reduce our level of consumption. A "doing more with less" slogan is popular among environmentalists. The fourth interpretation is that of those who see sustainable development as a sustainable economic growth per se.

[18] The Urban Governance Initiative (TUGI) – United Nations Development Programme (UNDP), Action for Better Cities: Tools and Methodologies for Good Urban Governance, Compiled by Saira Shameen and Sri Husnaini Sofjan (Kuala Lumpur: TUGI, 2000).

Part Two: Urban Level Theoretical Base
REEXAMINING THE IDEAS OF SUSTAINABLE CITIES

As the world is urbanizing, the role of cities in both environmental protection and economic development has become even greater. It is even more so in the developing world, which has been urbanizing more rapidly, not to mention parts of this world which have been economically and demographically growing more rapidly than the growth of their urban support systems. Understanding these contexts is the first step to understanding the concept of "sustainable cities" or "sustainable urban development."

The Roles of Cities in Economic Development

The relationships between cities and the economies have been widely discussed in various ways in the fields of urban economics, urban geography and economic geography as well as in the literature of the origins of cities (i.e. Mumford 1961, Morris, 1979, Bairoch 1988). As Lin (1994:7-9) indicates, there are those who argue that cities are socio-economically "parasitic" to the region,[1] and those who see cities as "generative" or act as catalysts of economic growth.[2] In that role, any significant change to the functioning of a city will certainly affect (in a relative scale) the development of the region to which the city serves, and from which the cities rely for resources and energy.

Many discussions refer to cities as the "engines of economic development." In the literature, this city's important role in economic development may be broken down into several overlapping roles as follow:

- There have been widely argued that cities--as concentrations of human activities--create agglomerations of economies, which furthermore provide a comparative advantage in the production, trade and distribution of goods, services and information. In some cases the exchanges of information lead to innovation (Castells 1989).
- Cities are also seen as to provide relatively more diverse, more abundant and often more rewarding job opportunities. "Average earnings in the city can be three to four times greater than in the country, though this figure does not include the monetary value of food self-sufficiency that rural people enjoy" (Girardet 1992:71);
- From a slightly different angle, cities are seen as to provide relatively more diverse and more abundant labor;
- Some scholars have argued that cities generate government revenues through taxes, often "more than the cities get back in governmental goods and services" (Jacobs 1984:106);

- Meanwhile, there have also been arguments that cities generate flows of capital to outside regions that supply agricultural, other nature-based products and labor (i.e. Hugo 1983 on the continuous monetary flows brought by circular migrants in cities of the developing countries).[3] In this regard, "cities are unique in their abilities to shape and reshape the economies of other settlements, including those far removed from them geographically" (Jacobs 1984:32). Moreover, in many cases, "farming areas are drawn within the economic orbit of cities, converting peasant self-sufficiency to cash cropping" (Girardet, 1992:71).

On the other hand, economic development also affects the way cities develop. Many cities have been able to improve their infrastructure and to make the urban environment healthier or more comfortable to live as a result of economic development. Some other cities actually suffer from their own rapid economic growth, when it is not accompanied by proper planning and infrastructure development, resulting in widespread traffic congestion, pollution and the like. In this sense, the development strategy chosen at macro level affects the situation at the city level.

As for the impacts of the Structural Adjustment Approach which has been widely adopted by many developing countries with the urge from many international aid agencies in the 1980's, for example, Bartone and colleagues observe that "in many parts of the developing world, urban poverty has grown faster than rural poverty because of macroeconomic adjustment, inefficiency in the urban economy, and misallocation of public resources. When subsidies are removed due to budget constraints and fiscal reforms, the poor face higher prices for food, shelter, and essential services. The weakest suffer the most" (1994:1-2)

Urban-related Environmental Problems

While cities play important roles in economic development, they also contribute significantly to the environmental problems. In both the developed and developing world, "the environment is profoundly affected by the way cities use land and other resources" (Lowe 1991:6) as well as by most activities in the cities. Some naturalists-aestheticists also suggest that "the economic forces, energy systems, climatic environments and formal landscapes that have shape cities too often result in environmental sterility and sensory undernourishment" (Hough 1994:11).

Moreover, Lester Brown of the Worldwatch Institute contends that "cities are inherently unnatural in that they require enormous concentrations of food, water, and materials in a [relatively] small area, concentrations far beyond anything [local] nature is capable of providing. And in turn, as these resources are consumed, they generate enormous quantity of

garbage and sewage. Just as nature cannot concentrate the resources needed to support urban life, neither can it disperse the waste produce in the cities" (in Girardet 1992:6). However, the notion of population concentration as a problem is full of contradictions, considering the alternative of spreading the same number people over a less dense but wider area (i.e. urban sprawl). The notion of compact cities we will discuss later as one of the attributes of sustainable cities is supportive to the idea of concentrating population. The question is how to make such concentrations environmentally supported in sustainable ways.

In this regard, at least there are three types of relationships between cities and the natural environment:

i) within the urban boundaries, cities change the natural environment (for better or worse); the boundaries themselves can also be expanding (the case of urban sprawl);
ii) within and outside the urban boundaries, cities extract and, in many cases, deplete natural resources,
iii) within and outside the urban boundaries, cities produce wastes and pollution.

Similar classification can also be made with regard to the impacts of cities on the people and human environment, inside and outside the boundaries. The fact that the environmental impacts of urban life can go far beyond the city's boundaries (Brown & Jacobson 1997; Cronon 1991; Platt, Rowntree & Muick 1994 and many others) has made the concept of sustainable cities more difficult to spell out.

This understanding of cities affecting environment and people outside the urban boundaries is also important for one other thing. Unlike many ancient cities – such as those in Sumeria, Mesopotamia or Teotihuacan – which collapsed or died because of a breakdown of supply or of human instigated natural disaster, and therefore could be seen as unsustainable (Girardet 1992:38-44), most modern cities have been spared from such a total destruction or demise because of the advancement of human technology and sciences. Yet this does not lead us to easily claim that modern cities are sustainable only because they have been able to survive. Before claiming sustainability for modern cities, though, we need to further understand how cities affect the livelihood in related areas outside these cities' boundaries in the long run. For an illustration, we may refer to a research on fuel-wood in India, which found that the larger the city, the faster and the farther the resource depletion it creates (Brown in Girardet 1992:7). Certainly, when we talk about the environmental impacts of a city, we cannot limit our observation only on the conditions and processes within this particular city but also those outside, and probably far beyond, the city.

Environmental Considerations in Urban Planning

While the terms of "sustainable cities" and "sustainable *urban* development" seem to be relatively recent,[4] environmental considerations in urban planning, design as well as management have already had a long history. The ideas or thinking suggested by Ebenezer Howard, George Perkins Marsh, Patrick Geddes, Lewis Mumford, Frederick Law Olmstead Sr., Raymond Unwin, Ian McHarg (1967/1992), Kevin Lynch (1960; 1981/1990) and many others have certainly included some ecological considerations with various degrees of importance. Some of them may indeed be seen as the early forms of sustainable city and planning models, though they may not use the same term. Howard's Garden City is perhaps the closest to one interpretation of a sustainable city,[5] while McHarg's Design with Nature is perhaps the closest to conform to the design process of a sustainable city.

Moreover, the field of environmental planning has been in existence for many decades. Environmental considerations have also been one of the traditional inputs in land use planning. Also, the study by Jellicoe and Jellicoe (1975/1995) indicates that throughout history and in many cultures people generally take environmental considerations in their activities that affect natural landscape.

However, the idea of "sustainable cities" is supposed to be more than just taking some of the urban-related environmental impacts into the considerations. Although the still-limited literature on sustainable cities has not offered any accurate and explaining definition of a "sustainable city,"[6] it gives some hints that ideally the concept should provide more fundamental solutions to the problems associated with the issues of environment and development from the urban point of view.[7] Here, what we could do is to review some of the issues regarding urban ecosystems, metabolism and sustainability as well as to analyze the distinctive attributes of a sustainable city offered in the literature, and finally, to briefly look at some of examples of real actions that have been taken.

Urban Ecosystem, Metabolism and Sustainability

As indicated in the previous section, the discussion about environmentally sustainable urban development cannot stop at the urban boundaries but it goes beyond these boundaries. In other words, the question can not only be about the long-term survival of cities because "they are here to stay," and conventional socio-economic and political considerations will justify the use of science and technology to maintain the survival of the cities, perhaps at any cost. The question should include the external impacts of maintaining those cities as well as the quality of life within and outside boundaries, and perhaps even more. And as indicated before, this

understanding contributes to the difficulty of defining the notion of sustainable cities.

Perhaps, understanding the concept of urban ecosystem[8] will help the efforts to define the notion of "sustainable cities." In this regard, we may see it as a "terrestrial ecosystem with a dense human population" (Numata 1975:221). The problem is that the "dense human population" here leads to the notion that it is mostly a "human managed" ecosystem, and therefore open the Pandora's box of social, economic and political factors.

This then brings us to the debate on the notion of bioregion,[9] which can be outlined as "a place defined by its life forms, its topography and its biota, rather than by human dictates; a region governed by nature, not legislature" (Sale 1985:43). The bioregionalists believe that bioregional consciousness is critical for human to have a sustainable habitat. It is assumed that by defining regions based on natural characteristics--instead of some human-defined criteria--many of the environmental problems will be mitigated, to say the least. For bioregionalists, the human's role is not to define regions but to gain consciousness over natural characteristics of the regions in which they live.[10]

Also important with regard to the notion of urban environmental sustainability is the concept of city metabolism.[11] It is a Gaian view which looks at cities as an organism. The ecologist Herbert Girardet suggests that "a city with a linear metabolism takes what it needs from a vast area, with no thought for the consequences, and throw away the remains. Input is unrelated to output. Nutrient are removed from the land as food is grown, never to be returned" (1992:23). Cities like this are called biocidic cities. "They have taken essentials without giving anything in return. They have taken food without returning fertility to the soil; they have taken forest product without contributing to reforestation; they have taken water without ensuring sustainable supply" (Girardet 1992:22).

Girardet furthermore proposes that "in a city with a circular metabolism every output can also be used as an input into the production system, thereby affecting a far smaller area" (1992:23). Girardet and many other ecologists argue that a sustainable city is a city with a circular metabolism and, hence, closed nutrient cycle. In a Gaian view, cities like this are called biogenic cities, which take a good care of maintaining the resources that support the lives of the cities. As an example, Girardet points to the traditional Chinese cities which returned human and animal waste to the belts of farmland that surround them (22). Many other traditional cities had similar practice.[12]

Examples of What the Literature Says about "Sustainable Cities"

Some of the themes in the literature on the idea of "sustainable cities" or "ecological cities" can be seen in the following examples. Berg (1992) suggests the following characteristics of an ecological city: (i) promotes ecollogically-designed buildings, (ii) reduces motor vehicle volume by promoting alternative means of transportation, (iii) promotes recycling program, (iv) provides more open spaces, (v) revives wild life habitat.

Meanwhile, Brown and Jacobson (1987), though do not explicitly mention the term "sustainable city" or "ecological city," indicate that such a city should: (i) reduce energy needs, (ii) promote food self-sufficiency, (iii) close the nutrient cycles (through nutrient recycling practices), (iv) be less demanding on water, fuel and other materials from outside, (v) be compact in term of its urban form, (vi) be in "balance" [not exploiting] with the country-sides or with other cities.

Likewise, Carlson argues that "cities striving for sustainability simply want to coexist within their local ecologies without draining their every resource and without overwhelming them with people and wastes" (1994:29). Carlson goes further to add other attributes such as recycling program, light rail lines, energy-efficient housing, protected greenbelts, farmer markets, and art centers.

Lowe (1991) does not mean to address the term "ecological city" literally, but she does lay out some characteristics that should be there in an environmentally sustainable urban development with a human dimension. The characteristics are; (i) integrated land-use and transportation planning or policies; (ii) land use pattern that promotes energy-efficient buildings and overall energy savings; (iii) proper land use pattern that helps protecting the water resources (aquifer/ground water as well as surface); (iv) land use control that considers everybody; (v) cities that are humane, with such features as livable streets, auto-free zones, rich greenery, farmer markets (seen as a way to re-establish links with country-sides), gathering places, pedestrian-friendly areas, and safe public spaces; (vi) promote more compact cities.

The Royal Swedish Academy of Sciences (1995) suggests the components of a sustainable city as follow: (i) should include the cultural, social and economic aspects of the whole urban-rural environment; (ii) should be perceived as beneficial by individual actors in the communities; (iii) the criteria for which should be defined in relation to local conditions and developed through broad-based public participation; (iv) conservation of natural resources and promotion of maintaining biodiversity and ecosystems; (v) promote human capacity to improve current conditions; (vi) provide equitable access to services for all citizens; (vii) prioritize the options that synergize socio-economic and environmental gains; (viii)

promote democratic decision making process; and (ix) respect indigenous knowledge and creativity.

Meanwhile, referring mostly to the conditions in many cities of the developing countries, World Resource Institute (1996) emphasizes four areas of priority if these cities of the Developing World are to improve their environment. The first area of priority is water and sanitation by (i) improving access to water and sanitation (through adopting appropriate technology and standards, involving communities, improving operation, maintenance and cost recovery); (ii) promoting water conservation; (iii) reducing water pollution (better urban sewage and control of industrial effluents). The second area of priority is solid waste management by (i) improving the informal waste collection; (ii) developing partnership with private sector; (iii) reducing waste generation. The third priority for action is the reduction of air pollution, including (i) addressing indoor air pollution; (ii) reducing energy sector emissions; (iii) promoting energy conservation; (iv) encouraging pollution prevention. The fourth priority is land use, which involves such issues as; (i) land for affordable housing; (ii) protecting land as a resource; (iii) promoting urban form that is benign to the environment; (iv) promoting integrated land-use and transportation planning; (v) strengthening the institutional framework for all actions above.

Two General Models of a "Sustainable City"

While there have been a significant amounts of efforts to explain the concept of sustainable urban development, as I have briefly indicate in the previous section, the idea of "sustainable city" is still far from fully explained. This section and the following one attempt to analyze the themes that have been discussed in the literature of "sustainable cities," and synthesize them into two basic models and five broad categories of attributes. In addition, there have also been some efforts to develop indicators for sustainable cities that need to be mentioned in this statement.

From the various themes discussed in the literature on sustainable cities – with the examples outlined above – I would suggest that there are two basic models of a sustainable city. Although there has not been any attempt to seriously link the themes in these two micro-level models with various interpretations of the macro-level concept of sustainable development, I would furthermore indicate here that the two basic models of sustainable cities can be associated with the two main interpretations of sustainable development we have discussed earlier. The two basic models are:

a. Sustainable cities as self-sustained/self-reliant cities.

Although the idea seems to be utopian and attracts controversy over its practicability, there have been some suggestions that indicate sustainable cities as self-reliant cities. However, while many authors have suggested that to be sustainable a city has to reduce – if total elimination is impossible – the amount of "intake" they consume from outside, there has not been any comprehensive elaboration of the range of the urban metabolism's components that can be self-provided. In this regard, Lester Brown contends that "closing nutrient cycles is thus one of the building blocks of ecologically sustainable cities" (in Girardet 1992:7). Similarly, Morris (1982) also suggests that to be an ecological city, a city has to reduce its dependency on imported energy[13] primarily through increasing efficiency and alternative sources from within the city. There have also been efforts to find alternatives to nature-based building materials--primarily woods--in order to reduce the natural degradation such as deforestation that the building industry helps cause.

Another idea in this category is the idea of urban permaculture, which was first suggested by Bill Mollison and has been implemented in several small communities in Australia and Europe. The idea proposes that cities should not only be green with more diverse trees but should also have adequate permanent farms and gardens to create self-sufficiency in foods, farm products, energy, and--ideally--other life support systems[14] (Ball et.al. 1986; Girardet 1992; Kennedy in Canfield 1990). With this, it is envisioned that local nutrients will not be lost and can be kept circulating within small localities. Yet, one of the problems with the idea of urban permaculture in particular--and the idea of self-reliant city in general--is that it seems to unrealistically envision no flow of capital in any form between the city and the areas outside. If this is the case, then it creates some unintended problems, such as where the farmers in rural areas should sell their products if all cities are self-supporting in garden and farm products. Regarding self-sufficiency, it seems that self sufficiency in energy – though still not an easy one – makes a better sense than self sufficiency in foods and farm products.

In an attempt to draw the line between the macro concept of sustainable development and the micro idea of sustainable cities, this study sees the model as a micro-level implication of the first macro-level interpretation of sustainable development, which envisions the maintenance of natural capital stock at or above current level.

b. Sustainable cities with the "thermostats" metaphor

Some authors envision sustainable cities, which are not totally self-sufficient but have some kind of mechanism to control their impacts, as Girardet suggests that "for cities to become sustainable, they need to develop a strong awareness of the ways they affect the world. They must

create their own control systems, acting like thermostats, continually monitoring their global and local environmental impacts" (1992:156).

In theory, the growing field of ecological economics has been developing some possible tools for this idea. For example, if the costs of environmental degradation or resource depletion in the supplying regions are counted in the economic transactions between the cities and the supplying regions, the resulting prices may act as the "thermostats." Similarly, if the costs of throwing wastes and pollution are attached to the volumes--and some other characteristics--of the wastes, there will be a self-control "mechanism" that would reduce the amount of wastes and pollution. Accordingly, this model can be associated with – and seen as an micro-level implication of – the second macro-level interpretation of the sustainable development concept that allows substitution or trade-offs between the natural capital stock and the other three types of capital stock, namely the human-made capital stock, human capital stock, and social capital stock.

The two models discussed above and their association with the macro-level interpretations of sustainable development can be summarized as in the table below:

Table 4. The City Level Implications of Sustainable Development

Interpretations of Sustainable Development	Implications at the City Level
1. **Maintaining total natural capital stock**: Sustainable development requires a maintenance of the total natural capital stock at or above current level.	1. "**Self-reliant model**": a sustainable city is "self-reliant" and "biogenic": - self-reliant in energy (Morris 1982); - urban permaculture (Ball et. al. 1986; others), which means self-sufficient in foods and farm products as well as adequately green; - completely circular metabolism/closed nutrient cycles (Girardet 1992), which means no waste is thrown outside the city;
2. **Maintaining total capital stock of all types**: Sustainable development allows depletion of the total natural capital stock as long as it is substituted by an improvement in any of the other types of capital stock (human-made, human and social capital stocks).	2. "**Self-control model**": a sustainable city is still allowed to use resources from outside sources and to send wastes across urban boundaries but it has to adopt a self-adjusting mechanism that works like a "thermostat": - adopts national and local accounting systems that include the real costs of ecological (and perhaps social) degradation; - investing the benefits of natural resource exploitation in human health as well as in the development of science and technology;

Five General Attributes of a Sustainable City

The literatures on the idea of sustainable cities as well as the examples of "best practices" in sustainable urban development provide some themes that can be seen as the attributes of a sustainable city. They can be synthesized into five broad categories of attributes. Both of the two models discussed above may possess all of the attributes below; they only differ in the magnitude or the scale of importance of any of the following attributes.

1. Sustainable cities are supported by "sustainable communities"

There are at least four aspects of "sustainable communities" that have been discussed in the literature on the idea of sustainable cities. They are:

i. creating a sense of community,
ii. respecting local socio-cultures,
iii. creating a livable environment, and
iv. accommodating broad-based participation.

Many authors (e.g. Benello, Swann & Turnbull 1989; Calthorpe 1993; Duany & Plater-Zyberk 1991; Katz 1994; Langdon 1994; Norwood & Smith 1995; Van der Ryn & Calthorpe 1986) suggest that the sense of community and the sense of place have been lost in many modern cities and that they have to be re-created in order to make cities more sustainable. Because most of the proponents of this idea are architects or urban designers, their solutions have mostly been physical such as the re-creation of better public space, less auto-oriented and more pedestrian-friendly environment and the like.

Traditional urban patterns are also seen as better in creating a sense of place than the modern ones do (Duany & Plater-Zyberk 1993). A sense of place can be created by respecting local culture. Malaysian architect/ planner Ken Yeang (1987a, 1987b) has been working on the urban forms and architectural expressions that are compatible to Malaysian culture. In doing so, he argues that it will contribute to the creation of sustainable cities in this country. Meanwhile, the livability of the urban environment is also seen as important in creating a sustainable community. Appleyard's pioneering work on livable street (1981) seems to be very influential. But the discussions have grown to the livability of various aspects of urbanity (Marlin 1992; *Making Cities Livable Newsletter* of various editions).

Broad-based participation is also seen as critical in the creation of a sustainable city. Most of the widely published "best practices" put a strong emphasis on broad-based participation in their decision making processes. This democratization of the process includes the idea of fundamentally empowering women, minority and the disadvantaged/under-represented groups of the local population. It is widely assumed that participation will increase the likelihood of creating more sustainable environment through better maintenance over local resources and investment as well as better understanding about local needs, which furthermore increase efficiency.

2. Sustainable cities are adapted to local bio-geophysical characteristics.

This is actually not a new preposition although in the past it was not associated with cities' sustainability. The fields of physical planning and landscape architecture have long been paying attention to this issue. Ian McHarg's classic *Design with Nature* (1967, reprinted 1992) is an example of such an approach. In urban design, the afore-mentioned Yeang's works (1987a, 1987b) and Soon's work (1989) also deal with some of the bio-geophysical--primarily climatic--characteristics of the tropics. And within the broad environmental movement, bioregionalists have long suggested defining regional boundaries based on natural characteristics instead of some criteria created by human. Moreover, this preposition should not only be limited to urban patterns or forms but also building design. Local

planning and design regulations, standards and guidelines are some of the tools mentioned in achieving this prerequisite.

3. Sustainable cities are healthy living environment

A special attention to the important of a healthy city has also been paid, and may be considered as important contribution toward a sustainable city. The idea that simply looks at "the whole of health and cities in relationship to its parts" (Duhl in Ashton 1992) has become a movement of its own (Ashton 1992). Because most of the proponents of this movement are from the public health discipline, it is quite natural that it puts more emphasis on the people's health, rather than on the city's health, in a Gaian sense.

Outside this "healthy city movement," there have also been other efforts to create healthy living environment. Some World Bank research and publications on intra-urban environmental health differentials in the developing countries (e.g. Bradley et.al. 1992, De Larderel 1994, Kreisel 1994) raise the concerns of unhealthy living conditions of the urban poor and imply that the improvement of such conditions is essential if the cities are to be made sustainable. There is also discussion on preventing the creation of stress-creating environment (Aicher 1994). In this regard, improvement of densely populated *kampungs* or slum areas should not only be seen from the view point of housing as one basic need but also from the need of healthier living environment both for the slums' residents as well as for other residents of the city.[15]

Moreover, the World Bank and several other international agencies have begun adopting the idea of sustainable cities in the developing world through better provision of urban infrastructure (i.e. Bartone et. al 1994; Cointreau-Levine 1994; Leitmann 1994). This is primarily related to fact that many urban environmental problems in the developing world – primarily those in the realm of environmental health – are associated with the lack of urban infrastructure. Various alternatives of affordable infrastructure have been examined and tried-out in this regard.

4. Sustainable cities minimize their "throughputs."

Besides reducing the "intake" that cities consume--as indicated in the "self-reliant" model but also exists in the "self-control" model--there have also been some considerable attention paid to the reduction of wastes and pollution that the cities create and thrown to non-urban areas. The well-known idea of reduce-reuse-recycle is part of this attempt. Recycle programs are now almost a common feature in many cities, which unfortunately are often used to justify more consumption. This can be further expanded to the idea of building and infrastructure recycling as well as the efforts to develop energy-conserving buildings and urban patterns.

The broad category also includes some planning approaches to reduce auto dependency such as in land-use/transportation interface (i.e Hall 1994 and many others) or transit-oriented development (Calthorpe 1993), as well as some preventive approaches to urban air pollution – such as in the green city movement (Dobson et.al. 1989; Gordon 1990; Johnson 1984; Mayur 1990), although the "greenery" suggested is usually multi-purpose, including for recreation as well as for aesthetic purposes.

Also included in this category is the notion of compact city. A study of cities around the world by Newman and Kenworthy (1989) found that the higher the average density of a city the less gasoline per capita it consumes. And one of the consequences of less gasoline consumed is assumed to be the reduction of natural resource extraction and of air pollution. Although there have been many critiques of this study, which are mainly based on its methodological approach, this study has nevertheless led to a widespread understanding that compactness is important for sustainable cities. The European Community, for example, has adopted this understanding by advocating compact city (Breheny 1992). The New Urbanism movement in the United States has also been advocating more compact human settlements – including through infill development – as opposed to urban sprawl.

5. Sustainable cities maximize their carrying capacity

Some of the attributes mentioned above – especially in Category 4 – can also be categorized as increasing the carrying capacity of the urban ecosystems, and therefore increasing the ability of the cities to sustain growth while minimizing the environmental impacts. Increasing green areas with denser vegetation can be seen as an example of the attributes in this category. Ideas such as compact city, infill development, respecting local physical conditions can also be seen from this viewpoint. The idea of increasing carrying capacity of the urban ecosystems is implied by optimism expressed in some parts of the literature that human's knowledge, science and technology do have their share in creating sustainable cities.

The five attributes discussed above can be summarized as follow:

Table 5. Attributes of Sustainable Cities

Main Categories	Physical Attributes	Non-physical Attributes
1. **Sustainable communities**: - a sense of community - local socio-cultures - livable environment - broad-based participation	Physical attributes associated with the New Urbanism (compact neighborhood systems, transit-oriented, pedestrian-friendly environment) are expected to contribute to the creation of a sense of community.Urban and architectural features that respect local socio-cultures.	Planning and other decision making processes as well as implementation that include a broad-based participation. Policies of empowering women, minority and the disadvantaged groups.
2. Adapted to local **climate** and local **biogeophysical** characteristics.	Physical realization of the non-physical attributes. (e.g. urban features that respect to tropical climate or earth-quake proof buildings).	Regulations, standards and guidelines for planning and design of cities and buildings that consider local climate and biogeophysical characteristics.
3. **Healthy** living environment	Adequate urban infrastructure (e.g. water, sewage, garbage collection) and facilities (e.g. local health clinics).	Policies or market mechanism that improve environmental health;
4. Minimize **throughputs** - reduce inputs, - reduce outputs,	Reduce inputs: facilities necessary for the use of alternative sources of energy (solar, wind); energy efficient buildings and facilities; compact city; transit-oriented & pedestrian-friendly environment, integrated land-use and transportation pattern that will reduce VMT, etc. Reduce outputs: recycling facilities; in-town waste processing facilities, etc.	Reduce inputs: policies or market mechanism to discourage the consumption on energy and other non-renewables, to increase the efficiency of resource use, to promote more compact development; etc. Reduce outputs: policies or market mechanism to discourage the production of waste (e.g. charging collection fees based on the amount of waste) and to encourage recycling. Supportive institution building and training programs.
5. Maximize **carrying capacity** of the urban ecosystems.	Increase green areas with dense vegetation to absorb more air, noise and heat (in the tropic); Maintain or protect water resources; more compact urban form; etc.	Enforce existing policies (or create new ones) that designate and protect green areas and other sensitive areas. (To avoid Hardin's "the Tragedy of the Commons" to happen, if all is left to markets.

Note: The difference between the "self-reliant" model and the "self-control" one in item 4 (reducing throughputs) is how far the efforts should go for a city to be categorized as sustainable. And this will define the types of efforts suggested.

The Goals and Indicators of Urban Sustainability

In addition to the models and attributes of sustainable cities discussed above, most authors in the literature of the subject also indicate five

characteristics of sustainable development that I would categorize them as goals rather than attributes. These are based on the three most frequently mentioned goals in Barbier's "trilogy" of sustainable development[16] plus two others that have been made more explicit since recently:

- ecologically sustainable (that the city should not develop beyond the ability of the ecosystem to sustain);
- economically viable (that the city should be well functioning in facilitating the economic needs of its citizens);
- socially equitable (that people in the cities are treated equally according to the rule of law);
- politically participatory (that all stakeholders have relatively equal access to the processes of public decision making);
- culturally vibrant (that different cultures are allowed not only to proliferate but also to enrich the city)

Also important to note here some attempts to establish indicators of sustainable communities or cities (Sustainable Seattle 1995), which include various indicators in at least five categories: environmental changes, social and demographic changes, changes in consumption of energy and natural resources, economic changes, changes in health conditions. An interesting development has been made in this regard where indicators are now selected not only by "the evaluators" but also by all stakeholders (through their representatives). People's participation in the selection of indicators in evaluating the sustainability of a city is certainly a move toward better governed cities.

Current "Best Practices" in Sustainable City Movement

Despite the on going intellectual debate over the idea of sustainable cities and, moreover, despite elusiveness of the idea, there have been some practical efforts to implement people's interpretation of sustainable city, comprehensively or partially, with or without the term "sustainable cities" or "sustainable communities." In the US, the most widely cited examples have been Portland and Seattle (at metropolitan level); Chattanooga (at city level); Davis (for some progressive--although partial--measures). Abroad, examples can be seen in Curitiba in Brazil, Hamilton-Wentworth in Canada, Gothenberg in Sweden, Tilburg in the Netherlands and some others. Many localities – not only cities but also counties – have adopted and consistently implement their own Local Agenda 21.

In the cities of the developing world, though, the actions have mostly been partial or sectoral, not as comprehensive as those in the cities of developed world. Limited financial and technological resources combined with the magnitude of the problems – especially the widespread poverty, accelerating urban population growth and the deficiency of urban services and infrastructure – have profoundly curtailed the progress in medium and large cities of the developing world in this regard. To cope with this

problem, some cities in the developing world have begun developing cooperation or partnership with cities in the developed countries, allowing the transfer of knowledge and technology.

Additional Discussions on Approaches to Sustainable Cities

While the progress in general should be acknowledged, many of the claims or arguments in the sustainable cities movement are yet to be studied more thoroughly, if not more scientifically. A few such studies have been conducted to verify, correct or challenge the claims. For example, critically responding to the claim that "transit-oriented development" is a way to develop cities in a more sustainable way, Cervero and Gorham find that "islands of transit-oriented neighborhoods in a sea of freeway-oriented suburbs seem to have negligible effects on transit commuting" (1995:210). Meanwhile, some other arguments in this movement have also been challenged on the basis of erred or incomplete assumptions or methods. Crane (1996) for example argues that the transportation benefits of the New Urbanism approach may have been "oversold." Still some more others are being challenged directly on the field by related parties (such as neighbors wary of increasing density as suggested by the New Urbanism in order to create a more compact and pedestrian-friendly housing area[17]), by economic reality (Barton & Landau 1995) or by regulatory inflexibility. On the other hand, there have also been fragmented reports on the economic benefits of environmental measures (i.e. Homsy 1995).

In the meantime, academic discourse with regard to the implementation of sustainable urban development in the developing world has been curiously less critical. Perhaps – due to the scale of the problems and the limitation of available resources – any progress is celebrated and seen as the first of thousands steps towards urban environmental sustainability in the developing world.

Notes:

[1]As examples, Lin refers to the works of Frank (1967), Harvey (1977) and Castells (1977).
[2]As examples, Lin refers to the works of Hoselitz (1960), and Singer (in Redfield and Singer 1954) of the Chicago school, Hirschman (1958), and Friedmann (1973), while McGee (1971) is said to have argued that cities can be both "generative" and "parasitic."
[3]In this regard, though, many environmental-economists contend that the current capital flows from cities to the supplying regions are much lower then they should have been if the costs of environmental degradation or resource depletion in the supplying regions were counted.
[4]As fashionable as the idea of sustainable cities right now, this idea received very little attention during the Earth Summit in Rio de Janeiro in 1992, as indicated in Platt, Rowntree & Muick (1994:9-10). Nevertheless, the agreement to further develop the Agenda 21 into local level agendas has contributed to the current sustainable cities movement. A parallel

movement is also happening with regard to the idea of ecological industries creating a new field of "industrial ecology."

[5]However, the history shows a little irony here. Despite its good intention to provide a green living environment free of pollution, the Garden City concept--and the New Town development that followed--had directly or indirectly promoted low-density suburban development which--combined with freeway construction and growing automobile industry--has resulted in urban sprawl, a contemporary urban environmental problems.

[6]An unexplaining definition is suggested by Register: "an ecocity is an ecologically healthy city" (1987).

[7]It is important to note here that many of the examples of sustainable cities in the literature and in the "Best Practices" being evaluated for the Habitat II may not necessarily meet this ideal of fundamental solution.

[8]An ecosystem--or an ecological system--is literally defined as "a functional system that includes organisms together with their physical environment" (Thorndike, E.L. & C.L. Barnhart. 1979. *Scott Foresman Intermediate Dictionary*. Glenview, IL: Scott, Foresman & Co.).

[9]The term "bioregion" was first popularized by writer Peter Berg and ecologist Raymond Dasmann in the 1970s (Alexander 1990, Sale 1985), perhaps as the first modern (non-traditional) environmental notion that deals with the concept of "space," "place" and "region." In this regard, bioregionalism acknowledges three levels of spatial scale: ecoregion, which is the widest natural region, with an example of the Ozark Plateau which covers some 55,000 square miles); georegion, which is smaller and physiographically more coherent, with an example of the White River watershed within the Ozark Plateau; and morphoregion, which covers a smallest natural territory of several thousand square miles with distinctive life forms on the surface (Sale 1985).

[10]See Merchant (1992:218-219) for examples of questions people need to ask themselves to have the consciousness expected by bioregionalists.

[11]Literally, a metabolism is a "process by which all living things turn food into energy and living tissue. In metabolism food is broken down to produce energy, which is then used by the body to build up new cells and tissues, provide heat, and engage in physical activity. Growth and action depend on metabolism" (Thorndike, E.L. & C.L. Barnhart. 1979. *Scott Foresman Intermediate Dictionary*. Glenview, IL: Scott, Foresman & Co.).

[12]Many modern-day Chinese cities, though, have departed from such practices as indicated by the study of Hong Kong metabolism by Ken Newcombe in the 1970's (Girardet 1992:26).

[13]Energy here is only one of city components that the author chooses for an example. The principle certainly can be broaden to other components.

[14]Although they have different origins and supporters, the idea of bioregions seems to fit with the idea of urban permaculture.

[15] From yet another viewpoint, such a *kampung* improvement can also be seen as an effort to improve the economic well-being of the kampung's residents.

[16]Serageldin and Steer (1994) provide perhaps the best yet elaboration of these three goals of sustainable development. Although there has not been a comparable elaboration for the micro-level concept of sustainable cities, many plans of actions that have been made by cities committed to create sustainable cities do try to include as many aspects of the three goals as possible (See The Royal Swedish Academy of Sciences 1995 and Sustainable Seattle 1995 for examples).

[17]As reported in *Planning*, Vol. 62, No. 1 (January 1996), p. 20.

Part Three: One Link to Practical Application
FRAMEWORK FOR THE ANALYSIS OF URBAN ENVIRONMENTAL SUSTAINABILITY

Introduction

As explain at the outset, this framework is intended to be used to analyze the environmental sustainability of an urban region. For example, it can also be used to complement the UNCHS' Indicators Programme. While this program "is designed to be a tool for monitoring progress towards achieving the goals of Global [and National] Plans of Action," it seems to have been limited to developing and collecting indicators.[1] On the other hand, various available methods of assessment of urban environmental sustainability[2] have also been limited with regard to their multi-dimensionality. This study is expected to provide a little contribution in this regard.

It begins the construction of the framework for the analysis of urban environmental sustainability by referring to several definitions of sustainable development or sustainability that have been cited in Part One and the six dimensions of sustainability: temporal/inter-generational, spatial, socio-economic, political, interspecies and inter-medium.

It is a bit surprising to find out that although many theoretical discussions with regard to environmental problems or with regard to sustainability often explicitly or implicitly indicate the multi-dimensionality of sustainability (e.g. Dryzek 1987; Fresco & Koonenberg 1992; Roth 1993; Barbier 1987; Serageldin & Steer 1994; and even the "practical" IUCN 1991), some of the definitions suggested – primarily the most influential and widely-cited one by the Brundtland Report – fail to show this multi-dimensionality. This situation, in some cases, has been carried through to the actual actions that have been taken by many urban communities in the world by deriving from these definitions. For example, various reports on the "best practices" presented during the Habitat II Conference indicate that most of them refer to Brundtland Report's definition of sustainable development and Barbier's three aspects of sustainability: social, economic and ecological as their starting point, hence carry through this lack of multi-dimensionality that both explanations of sustainable development suffer.

As mentioned earlier, environmental sustainability involves at least six dimensions: (i) spatial (environmental problem in one place can be moved to another place); (ii) temporal or inter-generational (environmental problem of the future generations can be created today without costing

today's generation); (iii) social-economic (environmental problem of one socio-economic group can be passed on to other socio-economic group); (iv) political (environmental problem of the politically powerful group or of those who have access to the decision making can be passed on to those who don't have political power or access to the decision making); (v) inter-species (environmental pollution can be passed on from one species – often human – to another) and (vi) inter-medium (environmental pollution can be passed on from one medium to another). This complex multi-dimensionality of sustainability, while discussed in many theoretical analysis, are often forgotten when it comes to the more practical analysis. The following discussion will further clarify what this study is trying to argue. It has to start with the definition of sustainability/sustainable development.

Defintions of Sustainability/Sustainable Development

Sustainability is admittedly difficult to define when it is used for other than in its original context of renewable resource utilization (such as in fisheries, grazing, and the like). No wonder that many people in action just simply use the most readily available definition of sustainable development by the Brundtland Report. It says that sustainable development is

> ".....development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (1987:43)

This definition clearly has temporal dimension. It can also be said, perhaps weakly, that it has socio-economic dimension because it talks about "needs." What is especially lacking from this dimension is spatial dimension. While it is perhaps acceptable when it is used in the global context (because there is no significant interaction with anything outside the globe yet), it can be very misleading when it is used at the local or urban level where the way the interactions with entities outside the urban boundaries is as important to sustainability as the "interactions" between generations.

For example, one generation in one locality may be able to meet their needs without compromising the ability of their descendants to meet their own needs, and may still not be categorized as sustainable because this community use up resources irresponsibly from other communities and allow the other environments of the other communities to deteriorate.

The same lack of spatial dimension also appears in Barbier's widely followed suggestion that sustainable development should be:

> ".....viewed as an interaction among three systems: the biological and resource [ecological] systems, the economic systems and the social systems" (1987).

While this explanation is useful to underscore the important of linkages between ecological and socio-economic goals (or the socio-economic dimension of the environmental sustainability), this is more a concept of goals rather than a definition. Therefore, it lacks of temporal as well as spatial dimensions and cannot be used as the starting point for the framework--even though it will be very useful in selecting the indicators.

For urban level analysis, spatial dimension is at least as important as the temporal and other dimensions. For this, let us then turn to a much less well-known definition of sustainability – not "sustainable development – by Holdren, Daily and Ehrlich.

> "A sustainable process or condition is one that can be maintained indefinitely without progressive diminution of valued qualities inside and outside the system where the process operates or the condition prevails" (1991:1).

Even though this definition is not widely cited elsewhere other than in the authors' paper, the study finds this definition most useful in the attempt to define environmental sustainability at the urban or regional level primarily because it explicitly shows the spatial dimension (the condition in inside and outside the system). If we adapt this definition to city (condition) and urban development (process) as well as to the case of urban land development, it will say as follow:

> A sustainable city is one that can be maintained indefinitely without progressive diminution of valued qualities inside and outside the city.
>
> A sustainable urban development is one that can be maintained indefinitely without progressive diminution of valued qualities inside and outside the region where the development is going on.
>
> A sustainable urban land development is one that can be maintained indefinitely without progressive diminution of valued qualities inside and outside the region where the urban land development is going on.

Because Holdren, Daily and Ehrlich's definition does not try to explain any paradigm of development (it is more for sustainability in general), it certainly lacks of socio-economic or political dimensions. However, this situation does not inhibit the use of this definition as the starting point

primarily because of its flexibility to be used in many situations as described above.

Diagramming the Analysis

Two basic models or diagrams that can be use to help the analysis of environmental sustainability are readily available:

- input/output models, which seems to be appropriate for the analysis of the spatial dimension of environmental sustainability;
- matrix diagram, which seems to be useful in the analysis of other dimensions;

Of course, like in any other model or diagram, these diagrams involve simplification of the real and much more complex world. As such they can be as complex as the diagram allows without reducing the readability of the models or as simple as it can be without eliminating too many important components. And certainly, there are several other models or diagrams that can also be used in similar analyses.

Spatial Dimension of Urban Environmental Sustainability

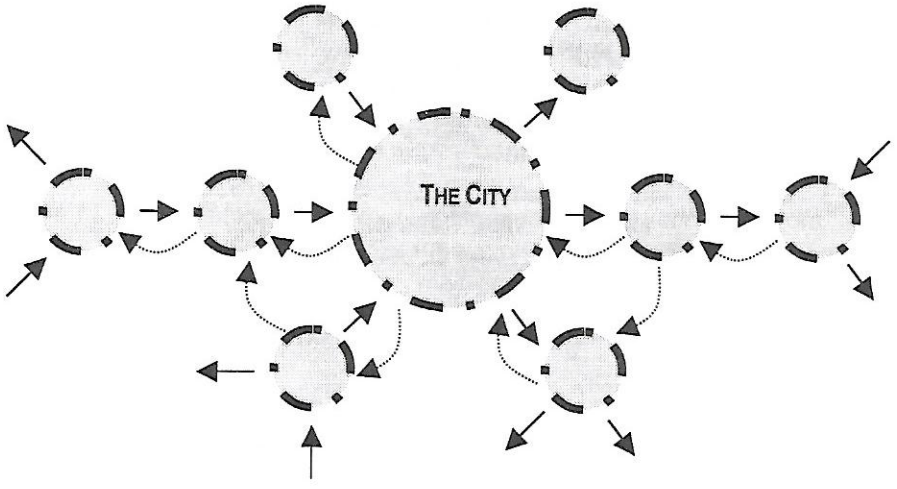
As indicated above, the I/O model is probably the most appropriate to be used in the analysis of the spatial dimension of urban environmental sustainability. The inputs can be food, water, timber, various building materials, fuels, and everything that the "system" need from outside. The outputs can sewage, wastes, pollution and other unwanted materials as well as wanted product of the "system" (the city). As discussed in Part Two, there have been many suggestions that a city needs to reduce the amount of throughputs. The more utopian "self-reliant" model certainly wants to close the cycle to create a "circular metabolism," whereas the more realistic "self-control" model requires reduction of the throughputs, at least on some ecologically important materials.

All of these suggestions to reduce throughputs (in both models) as discussed in the literature, however, fail to take the "city's positive product" into consideration. Is an increase in "urban productivity" considered as a decline or an improvement toward sustainability? The literature is not yet clear on the matter. A brief look at the reports on various indicator programs or on the "best practices" shows that "urban productivity" is considered an improvement from the sustainability point of view. The challenge here is perhaps how to increase "urban productivity" while decreasing the non-renewable inputs and those that have externalities as well as decreasing the unwanted outputs.

Example of simple I/O model:

SIMPLE MODEL

Example of complex (and more realistic) I/O model:



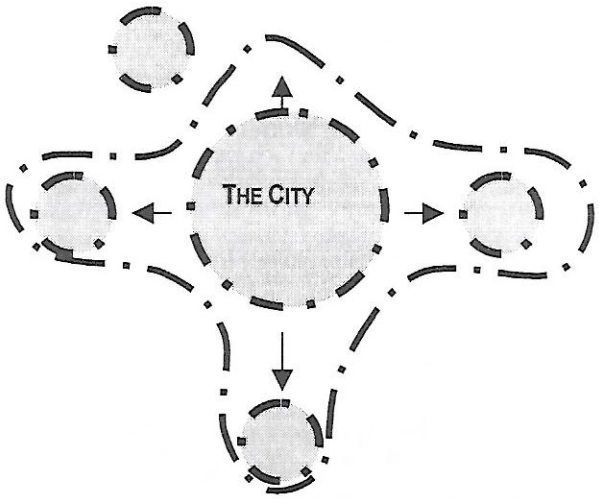
Note: All inputs and outputs can be positive or negative

COMPLEX MODEL

In the case of urban land development, the application is rather unique in a sense that unlike the movable food, wood, or others, the main input in this case stays put because it is in the form of rural/agricultural land (with all its economic, social and environmental functions). Meanwhile, the main outputs are both positive and negative impacts that the local peripheral municipalities experience: more formal housing, more local tax revenues,

increased land values, more local facilities, more pollution and wastes, loss of agricultural land, loss of wild-life habitats, and the like.

The urban land development case also unique in the sense that the place where the input originate and the place where the outputs end up in are the same place. It then becomes a part of the "system" (the city) because it is the system that is enlarging.



The Case of
URBAN LAND DEVELOPMENT

Temporal Dimension of Urban Environmental Sustainability

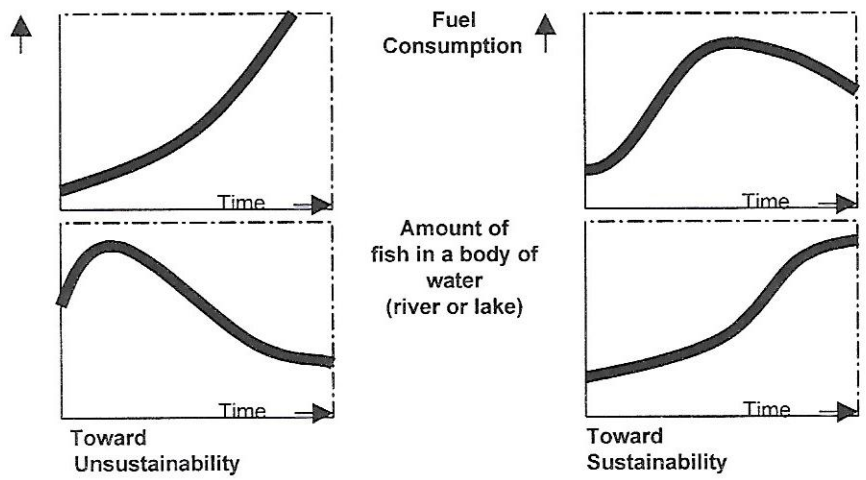
Meanwhile, for the analysis of temporal dimension of urban environmental sustainability, a matrix--such as the one illustrated below – can be a simple but useful tool.

Time / INDICATOR	T 1	T 2	T 3	.....	T n	Any Limit / Threshold ?
Indicator a						
Indicator b						
Indicator c						
⋮						
Indicator n						

social, economic & environmental conditions

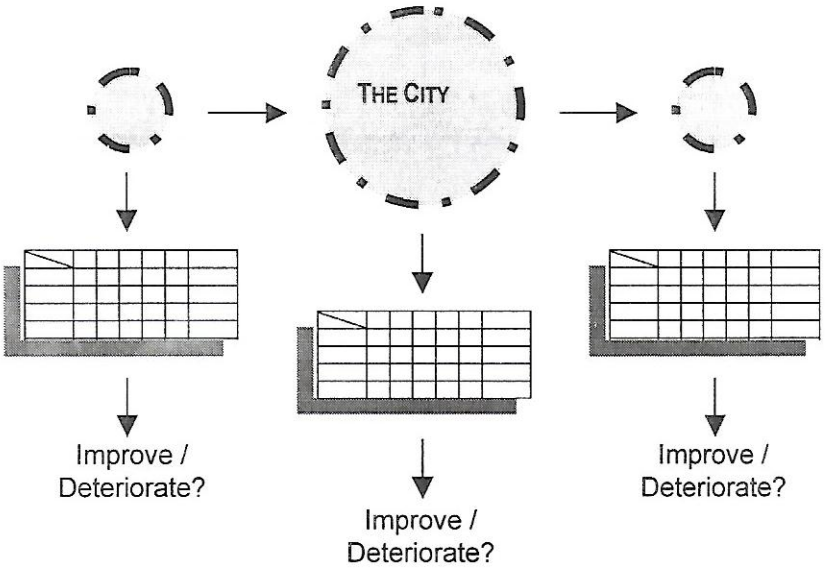
The indicators should represent changes in economic, social as well as environmental conditions of the region. They may include: population, rate of increase, median income (or expenditure), percentage of population living below poverty, percentage of workers with informal employment, access to urban facilities (water supply, sewerage, electricity, telephone, etc.), child mortality, life-expectancy, crime rates, water consumption, waste generated, pollution levels, air and water quality, percentage of green areas or open space, land tenure composition, and the like.

Some of the indicators above can be seen as "background indicators" and do not specifically indicate whether the region is moving towards or away from sustainability, while others may individually already indicate the trends with regard to sustainability as illustrated in the following examples of charts (see Wheeler 1995:71).



Combining the Analyses of Spatial and Temporal Dimension

Acknowledging that the changes of social, economic and environmental conditions in the areas outside the city--but affected by the city's activities--are as important as the changes of similar conditions in areas inside the urban boundaries, the matrix of temporal dimension analysis should be applied in both areas as illustrated below:

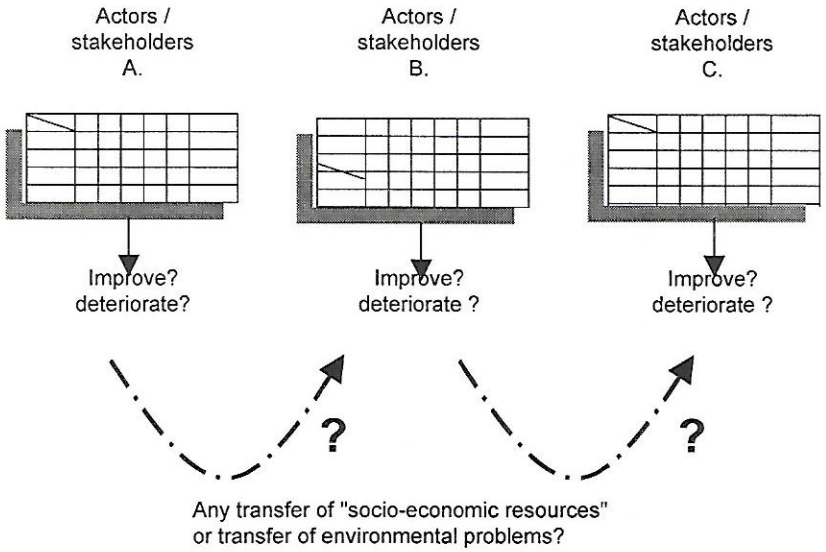


The Socio-Economic Dimension of Environmental Sustainability

The socio-economic dimension involves the following issues:

- changes of "well-being" (socio-economic conditions) experienced by the stakeholders over a period of time,
- changes in the living conditions (environmental conditions) of the stakeholders over the period of time,
- possible transfer of "socio-economic resources" from one group of stakeholders to another as a result of the changes in overall condition (the structure of the city) or of the process (the pattern of urban development), and
- possible transfer of environmental problems from one group of stakeholders to another with different levels of socio-economic status.

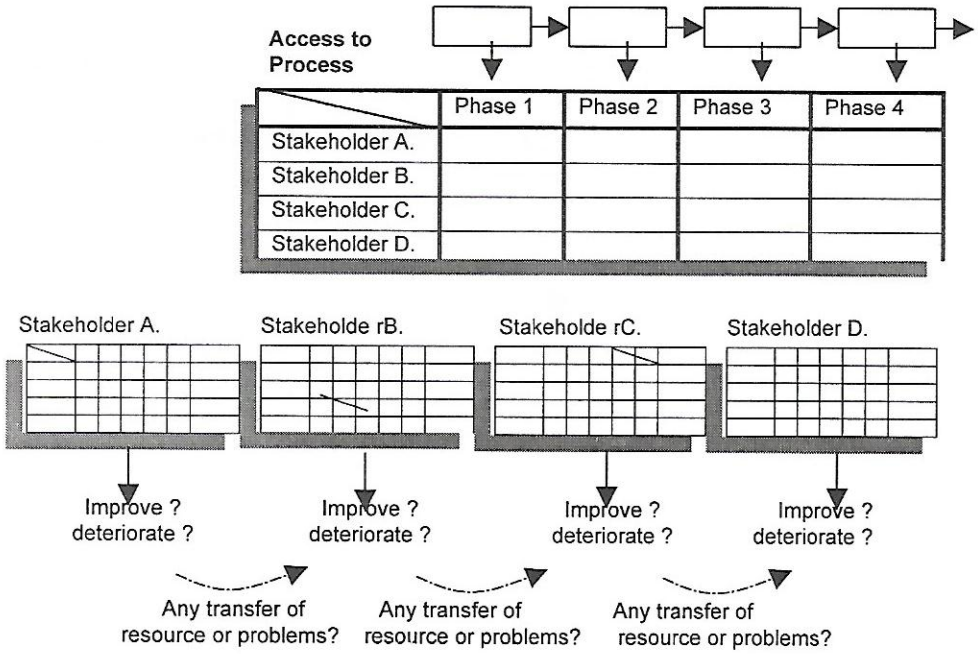
They are illustrated below:



The Political Dimension of Environmental Sustainability

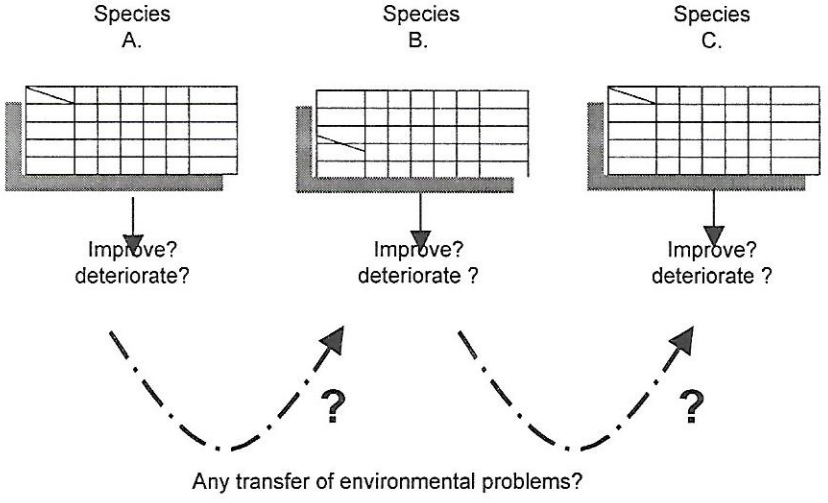
The analysis of the political dimension of urban environmental sustainability is specifically an inquiry whether there is a transfer of environmental problems from members of the population that have bigger political powers or better access to the decision making processes to those who have less. The consequence of this analysis is whether broad-based participation affect environmental sustainability.

The difficulty in analyzing this political dimension is found if we try to "measure" incommensurables such as political power, access to decision-making, participation and the like. It may involve such counting as the number of meetings in the decision making process that a stakeholder can attend (all meetings? only limited public-hearing? etc.) or the number contacts the stakeholder may need to deliver his/her opinion to an important decision maker/important agency.



On the Inter-species Dimension of Environmental Sustainability

This dimension is very well known – especially for the students of ecology -- but is not easy to comprehensively identify. Basically the framework reminds that this is one aspect that needs to be considered in any efforts to make cities sustainable. The importance for biological diversity in the overall living environment has been emphasized in the literature as well as in various real actions. Many non-governmental organizations – both international and local -- have been working in the areas. In fact this was an important component of the early environmental movement.



On the Inter-medium Dimension of Environmental Sustainability

This is a different kind of dimension than the other four dimensions of environmental sustainability in a sense that this dimension may be important in one case but may not be in existence in another case. It points to the possibility of transfer of environmental problems from one medium to another. For example, reducing solid waste through incinerator creates air pollution.

Notes:

[1] Which, in developing countries, is already a great challenge in and of itself.
[2] See Leitmann 1999 for some examples.

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