

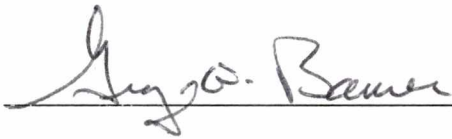
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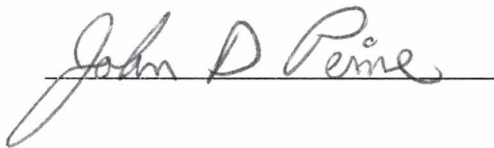
I am submitting herewith a thesis written by Leonida S. Corcuera entitled "Planning for Sustainable Communities: A Comparative Study of Indicators of Sustainability in Six U.S. Communities." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science in Planning.



Cecilia Zanetta, Major Professor

We have read this thesis and
recommend its acceptance:





Accepted for the Council:



Associate Vice Chancellor and
Dean for The Graduate School

PLANNING FOR SUSTAINABLE COMMUNITIES:
A COMPARATIVE STUDY OF INDICATORS OF SUSTAINABILITY
IN SIX U.S. COMMUNITIES

A Thesis
Presented for the
Master of Science in Planning
Degree
The University of Tennessee, Knoxville

Leonida S. Corcuera
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To Ross, Nice, Nikki, and Nadine
for their genuine love and support.

and

To all the children of the world
to whom we are indebted in making
this Earth a better place to live.

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ABSTRACT

Cities play a dynamic role in economic and social development and in managing the built and natural environment. Increasing awareness of the consequences of development in the environment and concern about a sustainable future has led many communities to plan for sustainability. Crucial to planning for a sustainable community is determining whether an urban area is moving towards or away from sustainability, which is gauged by various community indicators.

Sustainability indicators are quantitative and qualitative information, which assist a community in identifying its priorities and assess the community's long-term vitality. Indicators that show trends describe the impacts of human actions on the overall health of the community as well as call for positive actions to reverse any decline.

This thesis explores the dimensions of urban sustainability and synthesizes the characteristics of "good" indicators of sustainability using six indicators projects in the United States as an illustration. A comparative analysis was drawn along the major elements underlying the development of indicators in the six projects, namely: Santa Monica Sustainable City Program, Sustainable Seattle, Olympia/South Puget Sound Sustainable Community Roundtable, Life in Jacksonville, Boulder County Healthy Communities Initiative, and Sustainable San Francisco.

The indicators were classified into categories and subcategories to identify the indicators common to the six communities. In addition, the quality of indicators was evaluated using a ranking scheme – representing a range of criteria – which circumscribes the appropriateness of indicators as measures of sustainability. By

integrating the indicators used by at least four communities and the indicators that obtained scores of four or higher, this research arrived at a set of “good” indicators of sustainability. This set of indicators is perceived to serve as an example and guide other urban communities attempting to develop their own indicators.

This thesis emphasizes the importance of community participation in the quest towards sustainability. Planning for sustainable communities takes into account values and ethics and promotes community involvement in the conceptualization of sustainability and in making this concept operational, which can be achieved through the development and use of indicators. The involvement of diverse stakeholders ensures that the interests of all sectors in the community are considered and, thus stimulates immediate and appropriate actions from the community at large.

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CHAPTER 1

Overview and Introduction

1.1 Sustainable Development and Planning

Sustainable development has been defined in several ways and viewed in different perspectives. The most widely cited definition is articulated in the Brundtland Commission's report *Our Common Future* (1987) as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (p.43). This definition was complemented by the second World Conservation Union report (IUCN/UNEP/WWF, 1991) as "...improving the quality of human life while living within the carrying capacity of supporting ecosystems" (p.10).

Sustainability is a desired state or condition of any system over time while sustainable development is the process towards achieving sustainability. Ecological and resource sustainability are the most basic forms. The quality of life and the vitality of the economy are also at stake if ecological and resource sustainability are not achieved. Interactions between the environment, economy, and society are so important that policies to protect the environment must also include social and economic measures. Likewise, social and economic policies must include environment and resource conservation measures (Managing for the Future, Online). Therefore, sustainable

“renewed sense of purpose.” Thus, as Brugmann noted, unlike environmental planning, sustainable development planning is a social planning process which usually entails a long-term process of negotiation and partnership-building which simultaneously addresses social, economic, and environmental issues and links local actions with global outcomes. Conservation of natural resources, development of the built environment in harmony with the natural environment, and protection of the natural environment from pollution and degradation are three sustainability goals that the planning profession has pursued over years. Other goals such as social equity and greater community involvement have also been given emphasis in planning (Hall, 1995). What is new then is the increasing awareness of the complexity of the consequences of development in the environment within and across boundaries and the urgency with which these problems must be addressed in a sustainable manner.

1.1.1 The Urban Challenge

Statistical data provided by Haughton and Hunter (1994) reveal that in 1990, about 43% of the world's people was in urban areas – 72.6% in developed countries, 33.6% in developing countries; and 60% of the world's gross national product was produced in cities. Urban populations are the largest consumers of forest products and water and the largest producers of pollution and wastes. Under the assumption that abundant supply of energy would always be available, many cities in the United States have been built on technologies that prioritized economic goals. In the process, environmental consequences have often been neglected (Roseland, Online)

Population growth, advancements in technology and industry, and urbanization are, of course, some of the major driving forces of environmental change. It is not an easy task to maintain the balance between protecting the environmentally sound city, promoting the economically growing city, and advocating social justice (Campbell, 1996). As McDonald (1996) put it, "responding to the challenge of sustainable development has very important theoretical, technical, and practical relevance for planners..." (p. 225).

1.1.2 Sustainability Indicators

Measurement of sustainability is an essential component towards promoting a sustainable society. Indicators have been used to measure trends and evaluate environmental, economic, and social issues. In addition, they are intended to invoke action among stakeholders, including the public, at a national, regional, or community level.

Sustainability indicators can be used as a planning tool in order to make the principles and goals of sustainability operational. One of the steps in the process is the compilation and monitoring of accurate information. It should be emphasized that, although information can provide an improved basis for decision making and gauging progress, accountability is possible only if goals and measures of progress are explicit. Well-identified indicators can furnish such measures, providing a hint about whether the activities of people and economy are towards or away from sustainability (Hammond, Adriaanse, Rodenburg, Bryant, & Woodward, 1995).

There have been considerable efforts in different countries and communities to establish sustainability indicators. Their purposes are to develop better information collection and reporting systems, especially for natural resource indicators; integrate environmental, social, and economic indicators for greater sensitivity in planning and decision making towards sustainable development; and report regularly and reliably on conditions and trends (Tschirley, 1996). However, no set of indicators of sustainability has gained widespread acceptance.

The institutional and professional capacities of countries and communities to adapt and apply technology, to promote genuine participation, and to empower citizens and local groups are central determinants of failures and successes. The challenge, therefore, to planners and decision-makers is to ensure that indicators and information address these issues (Ibid, 1996).

1.2 The Research

1.2.1 Statement of the Problem

While volumes have been written on sustainable development, the concept has remained a focus of debates, ranging from definition to application and measures of sustainability. Only few examples have been cited on the application of the concept of sustainable development to an urban context. In fact, the notion of sustainable development introduced by the World Conservation Union totally ignored urban areas and although the Brundtland report touched the issue of urban challenge, it dealt mainly

in the context of Third World cities (Tomalty, Hendler, & Flick, 1994). Recognizing the dynamic role of cities in economic and social development, and in managing the interaction between the built and the natural environment, it is deemed worthwhile to adapt the concept of sustainable development to urban areas.

Also, there have been few attempts to make the concept of sustainable development operational. Translating the concept into practice will help in making effective policy planning and decisions. Measuring and reporting progress through indicators are critical to the long-term goal of community sustainability.

The key questions that this research seeks to answer are: What does sustainable urban development really mean? What is the importance of indicators of sustainability? For whom are indicators intended? What constitutes “good” indicators of sustainability?

1.2.2 Research Objectives

The primary objectives of this thesis are to explore the dimensions of urban sustainability and synthesize the characteristics of “good” sustainability indicators using six indicators projects in the United States as an illustration. The specific objectives of this study are to:

- Evaluate alternative definitions of sustainable development in the context of urban communities, including goals and measurement.
- Analyze different types of indicators of urban sustainability, their properties, the purpose for which indicators are developed and their intended audience, and the criteria for selecting sustainability indicators.

- Assess the indicators in the context of their relevance and usefulness as measures of sustainability.
- Based on the analysis, identify a menu of “good” sustainability indicators that can serve as a starting point for further development and selection by any urban community working towards sustainable development.

1.2.3 Research Methodology

Six indicators projects were selected for this research, namely: Santa Monica Sustainable City Program (Santa Monica, California), Sustainable Seattle (Seattle, Washington), Olympia/South Puget Sound Sustainable Community Roundtable (Olympia, Washington), Life in Jacksonville (Jacksonville, Florida), Boulder County Healthy Communities Initiative (Boulder, Colorado), and Sustainable San Francisco (San Francisco, California). These projects were selected primarily because of their urban focus, their illustration of the different elements underlying the development of indicators, and their significance to planning.

Key persons and organizations were contacted through telephone and e-mail to request updated and detailed information. Literature, both in paper and electronic forms, provides relevant and timely data.

Three types of analysis were made in this research. First, a matrix was made to compare the major issues underlying the development of sustainability indicators in the six communities. Second, the specific indicators identified by each community were classified according to the categories and subcategories developed by Hart (1995). This

classification provided the basis for identifying the indicators common in all the six sustainability initiatives. Third, indicators were assigned scores following Hart's ranking scheme, which is based on the indicators' fulfillment of a certain set of criteria for good measures of sustainability. The results of these analyses guided this research in establishing some "good" indicators that could appropriately describe and measure progress towards sustainability.

1.2.4 Research Structure

This research begins with a review of the several and often competing viewpoints of sustainable development. Chapter 2 discusses the holistic view of sustainable development as well as the early planning thought to determine to what degree the notion of sustainability is present in the planning literature.

Sustainability indicators are among the top items on the agenda of various levels of government and have stirred considerable interest from the general public. They play an important role in stimulating action and identifying priorities. Chapter 3 describes the different classifications and characteristics of sustainability indicators, the criteria being used in developing indicators, and the process underlying the development and selection of indicators. This chapter provides the framework of analysis of the indicator projects outlined in the next chapter.

Chapter 4 presents the assessment of the selected sustainability indicators projects focusing on the basic elements underlying the development and selection of sustainability indicators as a tool to measure progress towards sustainability. This chapter identifies

“good” indicators of sustainability based on coverage and quality ranking scheme developed by Hart (1995). It also provides a menu of “good” indicators by integrating the result of the ranking analysis with the most commonly used indicators in all six projects.

Chapter 5 provides the final conclusions from this research, a discussion of the prospects and limitations of the results of the study, and possible directions for future research.

CHAPTER 2

Sustainable Development and Urban Sustainability

Sustainable development is not a new concept. It has been used for years to describe alternatives to conventional approaches to development activities that are intended to prevent or minimize potentially adverse impacts on society and natural environmental systems. Concerns about the conditions of communities brought about by unrestricted economic development have paved the way to a broader planning approach which duly recognizes the interdependency of society and economy on environmental systems.

Sustainable development, although widely articulated in various fields of study, has remained vaguely defined. The literature has provided differing views and arguments, and a wide array of meanings and applications, sometimes causing confusion rather than clear understanding. On the one hand, the ambiguity of the concept is sometimes regarded as its strength, increasing acceptance by diverse interest groups (Redclift, 1991).

In addressing the question of "What does sustainable development or sustainability actually mean?", this chapter examines sustainable development in its generality and as it relates to urban areas in particular.

2.1 Historical Perspective

2.1.1 Early Planning Thought

The quest for a sustainable society brings a new age to the planning profession. However, it should not be ignored that early planning traditions were, in one way or another, related to current efforts at urban sustainability.

The best example of early planning effort is Ebenezer Howard's *Garden Cities of Tomorrow* (1902), the revised edition of *Tomorrow: A Peaceful Path to Real Reform* (1898). Responding to the problems of lack of affordable housing, air pollution and waste management, Howard's Garden City model proposed the establishment of new medium-sized settlement with laid out parks and civic spaces that would bring urban life into balance with nature. Howard's ideas of "greening" the city, preserving open space, and providing adequate air and garden space to the people are very much similar to those currently pursued (Hall, 1995). The protection of the natural and the built environment is one of the core themes of today's sustainable development planning. Also, current efforts of sustainable urban development aimed at reducing reliance on automobiles and greater opportunities for community development exemplify Howard's approach to compact, mixed-use regions, towns and neighborhood centers. It is apparent that Howard's garden city concept has inspired a vision for sustainable cities.

Ian McHarg's seminal book, *Design with Nature* (1969) fueled the subject of urban ecology and planning. McHarg asserted that urban development be based on a comprehensive understanding of natural features and ecological processes and that urban

infrastructure should harmonize with natural processes, not replace them (Tomalty, Hendler, & Flick, 1994, p.57). He also popularized the technique of producing overlays of various natural factors to assist in site design of what was later to become the Geographic Information System (GIS). The GIS is a significant tool in both diagnosis of and prescription for environmental problems and is now used in many planning tasks.

The works of Patrick Geddes, with his disciple Lewis Mumford, are also worth mentioning. They advocated the integration of conservation with planning, so that natural resource protection and city planning were soon intertwined (Blowers, 1992).

A utopian urban vision, Kevin Lynch's *A Theory of Good City Form* (1981) provides an overview of historical theories of urban form and design. Although it is not focused on urban sustainability *per se*, Lynch's work includes extensive discussion of ideal values underlying a good city form which resonate with present goals of sustainable urban development (Wheeler, 1996).

2.1.2 Sustainable Development as a Global Concern

Some of the first ideas of sustainability were introduced by a natural resource scientist, Aldo Leopold, who raised concern over an environment's ability to assimilate human demands and still sustain all of its life forms and processes (Geis & Kutzmark, Online). In his book *Sand County Almanac* (1949), Leopold stated that "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." (Platt, 1994).

Rachel Carson's *Silent Spring* (1962), which sounded an alarm on the adverse effects of human activities to the environment, particularly from the use of agricultural pesticides, instilled public awareness of the global ecological situation (Wheeler, 1996). *The Limits to Growth* by Meadows, D. H., Meadows, D. L., Randers, and Behrens (1972) made a major impact on world opinion with its discussion of important environmental considerations that limits growth: population increase, agricultural production, patterns of resource use, pollution generation, and industrial output. According to Meadows et al., the global ecosystems cannot support the severe constraints imposed by present human practices much beyond the 21st century, even with the advancement in technology. In spite of the criticism of its being too deterministic, *The Limits to Growth* stimulated interest in the effects of poverty on the natural resource degradation in developing economies, and the potential value of market forces as efficient instruments for environmental regulation and control (Perman, Ma, & McGilvary, 1996, p.56).

Although increased environmental awareness had started in the 1970s, the 1980s put a new light on the concept of sustainable development by indicating how both economic development and environmental protection may be harmonized to attain sustainability (Kozlowski, 1993). This was evident from a chain of significant world events and political actions.

UN Conference on Environment and Development

The first global conference organized by the United Nations was held in 1972 in Stockholm, Sweden. The conference helped usher in the modern environmental age. It emphasized the importance of managing the environment through the adoption of the

Declaration on the Human Environment, which contains 26 principles concerning the environment and development. Major results of the conference were the creation of the United Nations Environmental Program (UNEP), the call for cooperation to reduce marine pollution, and the creation of a number of national environmental protection agencies throughout the world (Haas, Levy, & Parson, 1992).

North-South: A Programme for Survival

As a result of a 2-year concerted effort by the Independent Commission on International Development Issues (ICIDI), this report, also known as the Brandt Report after its Chairman, Willy Brandt, was released in 1980. The report analyzes the world's economic and social dilemmas as they affect developing countries and points out that caring for the natural environment is an important aspect of development.

World Conservation Strategy

Shortly after the completion of the Brandt Report, the World Conservation Union, formerly the International Union for the Conservation of Nature, (1980) released the *World Conservation Strategy*. This *Strategy* was the first explicit attempt to develop a program of action centered on sustainability. It served as a catalyst for the political acceptance of sustainable development. The report presents a statement of conservation priorities and a broad plan for achieving them. Its central theme revolves around conservation to maintain the essential ecological processes and life support systems, to preserve genetic diversity, and to ensure that the utilization of living resources and the ecosystem in which they are found is sustainable.

Brundtland Report

The General Assembly of the United Nations set up the World Commission on Environment and Development (WCED) in 1983. The Commission was chaired by the Prime Minister of Norway, Dr. Gro Harlem Brundtland, and composed of representatives from 21 countries all over the world. For three years, the Commission evaluated and discussed peace, development, and environmental issues. The primary task of the Commission was to prepare a global agenda for change with the following objectives:

- To study the critical environmental and development problems and formulate realistic proposals for addressing them;
- To suggest new forms of international cooperation intended to promote the changes needed to solve these problems;
- To raise the awareness of individuals, organizations, private and government institutions and increase their readiness to take action (de la Court, 1990, p.10).

The results of the Commission's study were presented in 1987 in the book *Our Common Future*. Although set in the tradition of earlier publications such as *The Limits to Growth* and *The Brandt Report*, the Brundtland Report is different in two aspects (Ibid, pp.10-11). Firstly, it stresses the strong link between poverty and environmental problems. The report states that:

Environmental stress has often been seen as the result of the growing demand on scarce resources and the pollution generated by the rising living standards of the affluent. But poverty itself polluted the environment, creating environmental stress in a different way...

.... today's environmental challenges arise both from a lack of proper development and from unintended consequences of some forms of economic growth (WCED, 1987, p.28-29).

Secondly, the Commission is optimistic in its belief that sustainable growth is compatible both with environmental concerns and economic growth:

.... a new era of economic growth can be attained, one based on policies that sustain and expand the Earth's base... (Ibid, p.28).

The report of the Brundtland Commission, whose key concept is sustainable development, offers a concise definition that has become the most cited worldwide. One important conclusion in the report is the urgent need to address equity issues. In addition, it emphasizes that sustainable development should be everybody's responsibility and that the government and development agencies can play an important role in meeting the goal of sustainability.

United Nations Conference on Environment and Development

The 1992 conference held in Rio de Janeiro, commonly known as the Earth Summit, was the largest international conference ever organized. The Earth Summit approved three documents and adopted two other treaties (climate change and biological diversity). The three documents include:

- The Rio Declaration on Environment and Development is comprised of 27 principles stating the rights and responsibilities of individual nations with respect to the environment and aimed at ensuring the integrated pursuit of economic development and environmental protection.

- A declaration containing general principles for sustainable forest management.
- An action plan to guide the development of the Earth in a sustainable manner, popularly known as Agenda 21.

Agenda 21 is composed of six themes: (1) quality of life (2) efficient use of the Earth's natural resources (3) protection and management of our global commons (4) management of human settlements (5) use of chemicals and management of human and industrial waste, and (6) global economic growth based on sustainability (Sitarz, 1994). These themes seek to foster the sustainable use of natural resources for development while ensuring a healthy living standard for humans.

The Rio conference has been criticized for failing to tackle effectively the problems confronting the world. However, Agenda 21 was commended for stimulating international cooperation among government and non-government organizations, advocacy groups, and the general public (Haughton & Hunter, 1994, p.7). It highlights the importance of community involvement in environmental programs. In response to Agenda 21, a number of initiatives in creating sustainable development policies and programs by countries all over the world followed.

Organization for Economic Co-operation and Development (OECD)

As a follow-up to UNCED, the OECD brought together representatives from different countries in a workshop held in late 1993. The workshop was focused on sharing the past experiences and future strategies of national governments and international organizations with respect to preparing and implementing National Plans for

Sustainable Development. One of the major conclusions of the workshop was that planning for sustainable development should be a long-term perspective (OECD, 1995).

2.2 Evolvement of Definitions

The definitions of “sustainable development”, “sustainability”, and related concepts have developed over time. As mentioned earlier in this chapter, the literature on sustainable development has offered different interpretations. Indeed, much has been written just to examine the agreements and contradictions of the terms.

The *World Conservation Strategy* (IUCN/UNEP/WWF, 1980), contributed to the environment-development debate by emphasizing the need for ecological sustainability:

Development and conservation are equally necessary for our survival and for the discharge of our responsibilities as trustees of natural resources for the generations to come (p.1).

This message was reiterated by Talbot (1984) as:

Human beings, in their quest for economic development and improvement of the quality of life, must come to terms with the reality of resource limitation and the carrying capacity of ecosystems, and must take account of the needs of future generations (p.3).

In addition to supporters of the principles conveyed by the World Conservation Strategy, there are also critics. According to Pearce, Markandaya, and Barbier (1989, p.xii), the World Conservation Strategy failed to show what conservation might mean for

economic policy, or how misguided economic policy could degrade the environment, or how better economic policy could act as a major force to improve the environment.

Our Common Future (WCED, 1987) provides details of the economic, ecological, social, and political dimensions of sustainable development – setting the stage in making sustainable development an important issue throughout the world. It defines sustainable development as:

... development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (p. 43).

The WCED report also referred to sustainable development as “a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations.”

In general, reactions to the Brundtland’s report have been very positive. However, the report raised questions on the possibility of inconsistency between its growth objective and regard for ecological limits (van den Bergh, van der Straaten, & Koskoff, 1994). Many critics claimed that development is not the solution but the core of the problem not only of the natural environment but of human values as well. Daly (1993, cited in Lesh, D.R. & Lowrie, D. G., 1990; McManus, 1994) also noted that the Brundtland report failed to provide distinction between growth and development. “Growth” referring to an expansion in the scale of the physical dimensions of the economic system (quantitative change), and “development” referring to an improvement or degradation of a physically non-growing economic system in a state of dynamic equilibrium maintained by its environment (qualitative change).

An update of the World Conservation Strategy, the report *Caring for the Earth: A Strategy for Sustainable Living* (IUCN/UNEP/WWF, 1991), defines sustainability as a characteristic of a process or state that can be maintained indefinitely. The report stresses "... improving the quality of human life while living within the carrying capacity of supporting ecosystems..." (p.10). This definition corresponds to five broad requirements of sustainability: integration of conservation and development; satisfaction of basic human needs; achievement of equity and social justice; provision for social self-discrimination and cultural determination; and maintenance of ecological integrity.

In response to Agenda 21, the report of the U.S. President's Council on Sustainable Development (PCSD) embodies a national strategy for sustainable development and concludes that the United States must change by moving from conflict to collaboration and adopting stewardship and individual responsibility. The PCSD's vision statement describes "an economy that equitably provides opportunities for satisfying livelihoods and a safe, healthy, high quality of life for current and future generations" (PCSD, Online).

Along with the popularity of the Brundtland's definition of sustainable development came a series of other definitions. Considerable literature has been produced in various fields giving rise to the notions of sustainable urban/rural development, sustainable economy, sustainable forestry, sustainable development planning, sustainable land use, sustainable industrialization, sustainable agriculture, and much more.

2.2.1 Sustainable Urban Development as a Local Concern

Development is a dynamic environment-society process. Social and economic development are possible as a result of managing the natural environment, but the environment itself is not under social control (Dietz, Simonis, & van der Straaten, 1992). It must be recognized that many of the environmental and social problems communities are experiencing today are consequences of people's actions. Evidence suggests that due to a continued trend towards urbanization, the current patterns of resource use in the urban systems are becoming unsustainable, rendering a tremendous impact on the ecosystems.

Baines and Peet (1992) pointed out that the dynamic process in urban sustainable development *"must be seen not only in terms of individuals' actions, but also in relation to the aggregate behavior of communities and populations. Similarly, analysis of institutional arrangements must address interactions, not only between individuals and groups within society, but also between people and their environment"* (p.76).

According to Houghton and Hunter (1994), *"a sustainable city is one in which its people and businesses continuously endeavor to improve their natural, built and cultural environments at neighborhood and regional levels, while working in ways which always support the goal of global sustainable development"* (p.27).

Another definition is given by Richardson (1989, cited in Maclaren, 1996) who described sustainable urban development as *"a process of change in the built environment which fosters economic development while conserving resources and promoting the health of the individual, the community, and the ecosystem..."* (p.14).

In *Reviving the City*, Elkin, McLaren, and Hillman (1991) cited that “*sustainable urban development must aim to produce a city that is ‘user-friendly’ and resourceful in terms of its form, efficiency, function and as a place of living*” (p. 12).

According to Rees (1989), “*sustainable community development...creates a community that is healthy and caring, one that is socially and environmentally stable... .*” (p.49). Rees stressed the need to develop the human potential so as to find ways of meeting the long term economic and social objectives of the community within the limits of the natural environment and the constraints imposed by the demands of mankind.

2.3 Forces Driving Urban Sustainability

The concept of urban sustainability includes various aspects such as risk assessment, environmental policy, waste management, transportation, among others. Some of the factors that provide impacts on and potential opportunities for the community towards achieving sustainability are as follows:

Urban form

Urbanization can have adverse effects on the environmental quality of a community. Urban growth in cities resulting from increased population create spillover and sprawl, impacting the urban capacity to provide basic services such as clean water, affordable housing, and sanitation. On the other hand, physical development, i.e. subdivisions and highways, are normally resisted in rural towns and communities (Geis & Kutzmark, Online).

Limited resources

This includes both the natural and human resources. Cities are often faced with loss and deterioration of agricultural land, destruction of wetland and habitat, heavy demand for energy, and lack of skilled workers. The challenge for cities is to reduce resource consumption, emissions, and degradation of natural resources.

Social awareness

Increased sense of responsibility, sense of place, and sense of belonging have driven some people to aspire for a good quality of life and desire wide participation in resolving community issues.

2.4 Attributes of Urban Sustainability

Sustainable urban development can be characterized by a set of social, environmental, and economic goals specifically stated as follows:

Equity

This principle is the core of the Brundtland Commission's definition of sustainable development. Equity, which simply means "just and fair," can be described in two aspects: 1) inter-generational, and 2) intra-generational.

Inter-generational equity, which is equity between generations, calls for a true regard for the future. It means preserving the stock of environmental resources so that the needs of the next generation will be met.

Equally important is the principle of intra-generational equity or social justice, which means ensuring fair distribution of wealth and opportunity within and among communities, thus satisfying the aspirations of different groups in the community. Haughton and Hunter (1995, cited in Maclaren, 1996) described this as the undesirability of achieving economic growth in one community at the expense of environmental degradation in another.

Human potential

The human capital and potential of a community need to be conserved and nurtured, just like wealth and the ecosystem. Developing human potential through provision of the basic physical, social, and economic needs contributes to individual well-being. A sustainable community should be able to provide adequate and affordable health care and education and opportunities for jobs, recreation, and community involvement.

Empowerment

A sustainable community is one in which citizens, businesses, and organizations are given opportunity to participate and express their opinions in the environmental and socio-economic decisions that affect them.

Balanced development

Preservation of the natural capital is a condition critical to the attainment of sustainability. It should be recognized that a city is a part of nature. In order to be

sustainable, a city must protect nature and ensure that its activities are not interfering with the cycles of the natural ecosystem. As a starting point for sustainable urban development, a sense of responsibility toward the Earth's natural environment must be factored into all urban planning (Wheeler, 1996). Nature can be enhanced in cities by preserving open space, building greenways, and creating "urban forests." Similarly, patterns of development should be those which consume energy at a minimum level and promote reuse of buildings.

Environmental integrity

Sustainability implies resource consumption within the carrying capacity of the renewable resource systems. Use of non-renewable energy and mineral resources should be done in the most efficient ways possible. Adhering to renewable substitutes, using alternative clean technologies, and practicing conservation measures such as "reuse, reduce, and recycle" can prevent or slow down depletion of natural resources.

Sustainable urban development deals with minimizing waste production and waste disposal such that the waste discharges are within the capacities of the natural environment. It also treats waste as a potential resource through recycling. Efficient planning of urban waste disposal would eliminate or reduce production of hazardous substances that may adversely affect human health.

In a sustainable urban practice, land and resources are efficiently allocated and used in such a way to reduce sprawl. A compact urban form in which lesser space is occupied by the built environment results in economic efficiencies in the provision of

public transport services, and thereby reduces dependency on the automobile as a form of transportation (Maclaren, 1996).

Economic vitality

Sustainability views the economy as an open subsystem within the finite and physically closed ecosystem of the earth. While limits to growth are well recognized, a sustainable economy should regard satisfying the basic needs of its people. Also, economic growth can be a means towards increased security and social equity within communities if benefits derived from it are broadly accessible to everybody (Center for Sustainable Communities, Online).

Diversity in community system

A diverse urban environment, in terms of its ecological, economic, and cultural components, provides opportunities for learning and is more adaptable to change. This urban character can help promote sustainability. A sustainable community does not segregate populations or elements of nature but rather integrates them into the substance of the community.

2.5 Synthesis

It is recognized that no definition of sustainable development and related concepts are universally acceptable. However, there is a growing consensus about the characteristics of sustainability. These characteristics as mentioned above sum altogether

into environmental integrity, economic vitality, and social well-being (Dilks, 1995).

Although some communities treat these aspects of sustainable development separately or give priority to one over the other, most noted and acceptable definitions of sustainable development encompass all the three dimensions (see Figure 1).

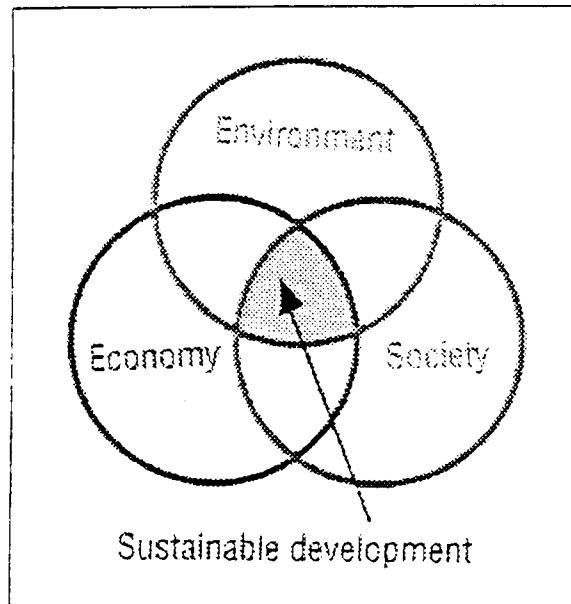


Figure 1. Dimensions of Sustainable Development

Source: Adapted from Dalal-Clayton, B. (1993, May). "Modified EIA and indicators of sustainability: First steps towards sustainability analysis". *Environmental Planning Issues. No.1.*

The challenge of this integrated concept does not necessarily imply "more planning" but rather an "efficient planning". Planning must involve a range of measures which can help create a balanced economy. More generally, a plan should be limited to what is feasible and possible. However, it should be stressed that a plan is only the beginning of a process in which questions of implementation must be addressed (OECD, 1995). Crucial to this effort is determining whether an urban area is moving towards or away from sustainability, which is gauged by various community indicators. In carrying

out this task, planning for urban sustainability should involve not only the policy-makers but also the general public.

CHAPTER 3

Indicators of Sustainability

Translating the principles and goals of sustainability into an operational form requires the development of sustainability indicators. Initiatives on sustainable development indicators started in the 1990s as prompted by the Rio Earth Summit:

Indicators of sustainable development need to be developed to provide solid bases for decision making at all levels and to contribute to self regulating sustainability of integrated environmental and development systems (UNCED, 1992, cited in Mitchell, 1996).

In 1994, the United Nations Centre for Human Settlements (UNCHS) launched its Indicators Programme which aims “to strengthen the capacity of institutions at all levels to monitor shelter conditions and urbanization process using a minimum set of substantially uniform and consistent indicators.” The programme, participated in by more than 200 cities and 100 countries, is designed to assess the sustainability of urban areas using key indicators including 27 urban, 10 housing, and 9 background indicators (UNCHS, 1997).

Literature on indicators can be traced back to the 1960s. For decades, only economic indicators, such as the Gross National Product (GNP)/Gross Domestic Product (GDP)-based Systems of National Accounts (SNA), have been available to policy makers to measure progress and the health of the nation. The limitation of economic indicators

in accounting for significant non-economic factors, such as the health of the population, equal opportunity among individuals, urban housing, transportation, and others, has prompted efforts to develop quality of life and social indicators.

There are also some concerns about measures of environmental quality. Environmental information collected by various agencies is often fragmented and uncoordinated, thus hampering their usefulness in policy making. It is often difficult to identify physical indicators because most data sets are collected at different scales and stored in different formats. According to Matthews and Tunstall (1991, cited in Dalal-Clayton, 1993), “economic planning would be unthinkable without GNP figures, unemployment rates...; so would social planning without such indicators as life expectancy and rates of fertility... and literacy. Yet, environmental policy making has no comparable measures today.”

Emerging interest in sustainability issues that accentuate the interdependence of all aspects of human activity with the natural environment has spurred efforts on indicators of sustainable development. New sets of indicators need to be worked out that would guide decision makers in their assessment of environmental quality as well as to enable the integration of environmental, economic, and social concerns for sustainable development planning. Only with the support of sound environmental measures could pertinent policy be made, with priorities chosen and targets for improvement specified (Carley & Christie, 1993). More recently, indicators have also come to be seen as tools for communication (Macnaghten & Jacobs, 1997). A number of communities have undertaken initiatives to develop sustainability indicators for many purposes, such as

measuring progress or getting an overall perspective of where a community is, where it is going, and how far it is from chosen goals and targets.

3.1 Development and Selection of Indicators of Sustainability

To make the concept of sustainable development operational, indicators should be developed and selected based upon a coherent framework. This framework consists of the definition of sustainability (discussed in Chapter 2), the program objectives, the intended users, and the criteria used in selecting indicators.

3.1.1 Defining Indicators of Sustainability

As a starting point, the typology of indicators is considered. Dalal-Clayton (1993, p.7) makes a distinction among sustainability indicators and sustainable development indicators. Sustainability indicators measure the distance between that change and a sustainable state of the environment. This definition of sustainability indicators was reinforced by Opschoor and Reijnders (1991) as: “normative measures of the distance between current states and the reference situation.” On the other hand, sustainable development indicators measure progress towards the broader goal of sustainable development in the national context. For the purpose of this research, sustainable development indicators and sustainability indicators are used interchangeably.

Verbruggen and Kuik (1991) noted that indicators are a compromise between scientific accuracy and the demand for concise information and may be used for two intertwined purposes:

- planning: problem identification, allocation of socio-economic resources and policy assessment; and
- communication: warning, mobilization and legitimization of policy measures

To serve these purposes, adequate information is needed. This information should clearly indicate whether objectives are met, characterize the system as a whole, be of a quantitative character, be comprehensible by non-technical persons, and contain parameters which can be used for longer time periods.

The definition of sustainable development, as well as the indicators that describe it, is unique to each community. In the United States, there are a number of community projects and programs that deal with developing sustainable community indicators. According to Sustainable Seattle (1995) indicators are “bits of information that highlight what is happening in a large system.” Sustainable Seattle described good indicators as “bellwether tests of sustainability and reflect something basic and fundamental to the long-term cultural, economic, social, environmental, or social health of a community over generations.”

3.1.2 Classification of Sustainability Indicators

Sustainability indicators, as defined, embody the integrative concept of environmental, economic, and social health of the community. Although there are a

number of ways by which communities organize their indicators of sustainability, there is an apparent agreement that the indicators encapsulate the fundamental characteristics of a sustainable community mentioned in section 2.2.3, which are environmental integrity, economic vitality, and social well-being.

According to Hart (1995) the categories of indicators used often in sustainable urban development are economy, education, environment, government, health, housing, population, public safety, recreation, resource use, society, and transportation (Table 1). Hart stressed that some categories overlap with other categories, such as the case of resource use which could also be included as a subcategory of environment or economy. Similarly, overlaps among specific indicators are always possible and in fact, are encouraged. For example, a land use indicator could be included under environment, recreation, or transportation. Despite the arbitrariness of any classification system, its usefulness lies on the potential for systematic comparisons, thus Hart's classification system was adapted for the purposes of this research.

3.1.3 Characteristics of Sustainability Indicators

The development of indicators requires careful consideration of who are the intended users, what message needs to be conveyed, and what are the purposes of the program.

**Table 1. Classification of Indicators
By Category and Subcategory**

Category	Subcategory
Economy	Business activity Children in poverty Diversity in the workplace Employment Local food production Housing availability Income Innovative capacity Resource use Sales Savings Service accessibility Small Business Tourism Training opportunities
Education	Adult life long learning Children attendance and preparedness Cost Racial and ethnic diversity Employment support Literacy Post-secondary School infrastructure and curricula Skills achievement Teacher sufficiency and preparation Training programs Volunteer programs to support schools Youth attitudes

Category	Subcategory
Environment	Air quality Awareness Biodiversity Drinking water Fish populations Forest health Groundwater Hazardous waste clean-up Land use Noise reduction Soil erosion Surface water quality Visual landscape Wetlands
Government	Diversity and foreign language use Effectiveness Inter-government cooperation Leadership Model role Participation and civic involvement Services provision Tax revenues

Table 1 (continued)

Category	Subcategory	Category	Subcategory
Health	Access to care	Recreation	Accessibility
	Health care expenditure		Land use
	Disease incidence	Resource Use	Energy
	Drug use		Hazardous materials
	Fitness		Hazardous waste generation
	Infant mortality		Recycling/reuse
	Insurance		Sewage and wastewater reduction
	Mortality		Solid waste generation
	Pregnancy/Birth		Water
	Safety hazards		
	Service quality		
Housing	Independent adult/senior citizens	Society	Abuse of vulnerable groups
	Availability		Child support and care
	Condition		Connectedness
	Cost		Culture and arts exposure
	Expenditures		Diversity and discrimination
	Homelessness		Mental health
	Ownership		Teen pregnancy
Population	Demographics		Social and environmental equity
	Diversity		Volunteerism
Public Safety	Accidents	Transportation	Air traffic
	Civil Emergency response		Bicycle
	Crime incidence & neighborhood watch		Commute
	Domestic violence		Cost
	Drug incidence and prevention		Infrastructure
	Juvenile crime		Land use for streets
	Traffic accidents and law enforcement		Public transit
	Violence		Vehicle use and fuel type

Source: Adapted from Hart, M. (1995, May). *Guide to Sustainable Community Indicators*. Massachusetts: QLF/Atlantic Center for the Environment.

Indicator properties and the indicator user

The amount and type of information incorporated in the indicator are determined according to the types of target users (scientists, policy makers, and the public). These information needs are illustrated in Figure 2. Approaches to indicator construction relevant to these users are the set of specific indicators, composite indicators, and key indicators.

Sustainable development indicators that can communicate relevant technical information in a precise way are mostly useful to scientists and policy makers working in specific disciplines. The public needs simple indicators that are easy to understand so that action in favor of sustainable development is encouraged. Integrating indicators that

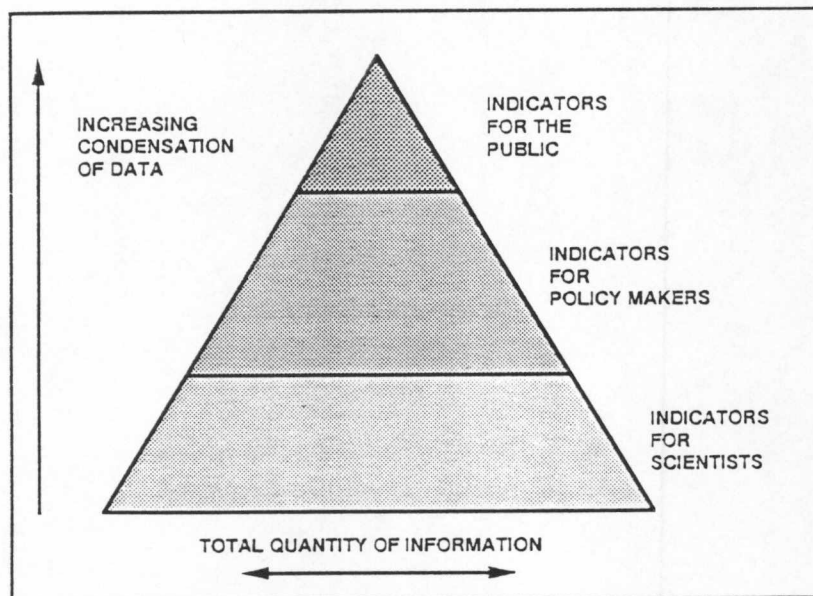


Figure 2. Relationships between Indicators, Data, and Information

Source: Braat, L. (1991). The predictive meaning of sustainability indicators. In Kuik, O. and Verbruggen, H. (Eds.), *In Search of Indicators of Sustainable Development*. Dordrecht, The Netherlands: Kluwer Academic Publishers.

illustrate the linkages among the social, environmental, and economic concerns of the community also serve the public. The Sustainable Seattle indicator for measuring the runs of wild salmon returning to local streams to spawn each year depicts a good example. This is a key indicator that integrates specific indicators of water quality, economic vitality, as well as the value put on the cultural heritage of the region.

Composite indicators, which combine two or more single indicators, can also be useful as integrative indicators. However, they are not key indicators because they tend to be more comprehensive and the target audience is more specialized.

Indicator properties and program objectives

Sustainability indicators should be forward-looking in order to measure success towards intergenerational equity (Maclaren, 1996b). Forward-looking indicators are designed to address different objectives. These indicators include descriptive or trend indicators, predictive indicators, and projective indicators.

Indicators that describe past or present conditions are the simplest type of forward-looking indicators and are referred to as trend or "bottom-line" indicators. These indicators can provide signals about the future as they depict changes in trend. They are then useful for reactive policy-making (Ruitenbeek, 1991). Descriptive indicators require only collection of the data and simple analysis to provide the necessary information. An example is the amount of ozone-degrading gases emitted in the atmosphere.

Predictive indicators, usually represented as bottom-line unconditional predictions, depend on mathematical models and some type of scientific law to characterize the future state and development of variables describing the environment,

economy, and society. They are useful when policy-making requires a proactive approach. An example of a predictive indicator would be that exposure to a specific amount of dioxin in air or soil would result in a certain number of cancer incidents.

Other forward-looking sustainability indicators are the early warning or projective indicators. These indicators are supported by data collection and require a more thorough analysis (statistical methods) than the trend indicators. They should also include specification of definite conditions or scenarios. Mitchell (1996) illustrated that a trend indicator of river quality could be the population of fish while an early warning indicator could be the level of dissolved oxygen. Such indicators could then be used to control and manage waste input to the river to protect the fish against unacceptable water quality.

3.1.4 Criteria for the Selection of Indicators

In addition to the characteristics discussed in the previous section, “ideal” or “good” indicators of sustainability should meet some general criteria. Indicator selection criteria help in summarizing the important characteristics that data should fulfill. These characteristics help determine whether the indicators selected for a specific application can address the desired policy or management questions (Schulze & Colby, Online). Regardless of the scope of the indicator project (whether it be social indicators, environmental indicators, or quality of life indicators), the selection of indicators is guided by fundamental criteria. These criteria as summarized below could be useful for choosing appropriate sustainability indicators.

Policy relevance

Indicators should be directly relevant to the policy goals of sustainability throughout the stages of the project, from developing a strategy all the way to implementation and evaluation. Similarly, they should be capable of being changed by the use of policy instruments.

Representativeness and linkage

Indicators should well represent the whole spectrum of human activities related to economy and environment. Effective indicators should show the interdependency among the social, economic, and environmental concerns of the community.

Measurable, comparable, and cost-effective

Indicators should be quantifiable using already existing data, at the least cost. If data are not readily available, a practical way of collecting data using present technology can be adopted.

Preferably, indicators should be comparable over time and with other cities, counties, or communities to evaluate the impact of policies and regulations. In most cases, accessibility of environmental data is a problem. Most environmental data available at the urban scale are those of local concern or are limited to those required by laws for municipalities to monitor (Alberti, 1996). Thus many projects on urban sustainability indicators include those beyond the boundaries. Such is the case of Sustainable Seattle in which indicators referring to the city limits, the county, and other places are incorporated, depending on the context and accessibility of data.

Accuracy

Indicators should be based on reliable and current data. Data and indicators should be regularly updated.

Understandable and acceptable

Indicators are 'models' that use data to present complex subjects in a simplified manner. It is suggested to keep the indicators simple and of limited quantity. Redefining Progress (1997) cautioned that too many indicators could be overwhelming to the community, thus oftentimes information are ignored. On the contrary, too few indicators will give an incomplete picture of the community.

Indicators should be easily grasped and understood by all stakeholders (especially the non-technical persons) to be an acceptable tool for measuring success or failure of strategy. Braat (1991) added that indicators should be carefully selected to avoid social bias because target groups may include decision-makers from various political and ethical convictions. They can better serve their purpose if they are developed and selected based upon community consensus.

Responsiveness

They should be sensitive to changes in the environmental conditions and related human activities. Indicators which stay constant over the years tend to lose their value while indicators that are too volatile will be hard to interpret or collect (UNCHS & World Bank, 1997). However, the long-term view of sustainability indicators should always be taken into account in the process of choosing indicators.

Analytical soundness

Indicators should have technical and scientific bases. They should be capable of linkage with economic models and information systems.

Include reference values

Indicators should represent normative measures of the gap between current conditions and reference values equated to sustainability. These reference values could be some target or threshold. A target could be a past or future level that is considered as more desirable than the present. The threshold may be regarded as the level of the indicator beyond which a particular system is no longer sustainable (Maclaren, 1996b).

Attractive

Indicators should be carefully designed and reported to stir users' interest, including the media.

3.2 Process in Developing and Selecting Sustainability Indicators

This section outlines the basic steps in choosing sustainability indicators. It should be noted, however, that this is not intended as a prescriptive tool since the effectiveness of indicator sets ultimately relies on their usefulness and relevance to the community, regardless of the manner in which they are developed.

Analyze the problem and define the goals to which the indicators are linked

Careful analysis of the conditions of the community is necessary to be able to identify the specific goals. In a community participatory process, the most popular approach in goal identification is visioning wherein diverse groups of people gather together to express their values of the community and how they want it to be in the future.

Formulate a framework

To ensure that indicators are appropriately selected, it is necessary to set the boundaries within which the indicators are going to operate. This framework specifically identifies the target audiences who will be using the indicators and the types of information embedded in the indicators.

As previously mentioned, the range and type of information vary with the type of target audience. Figure 2 illustrated that scientists prefer disaggregated raw data that can be analyzed statistically, while policy-makers are more interested in data that are related to policy objectives and are more condensed. On the other hand, the public and the media prefer indicators that are concise and straightforward.

Identify potential set of indicators

Reviewing the existing efforts on indicators would give an idea on what are the important deciding factors for selecting sustainability indicators. A set of general selection criteria, as enumerated in section 3.1.4, is a good starting point in determining potential indicators for the community and evaluating their validity. It is sometimes

impossible to find a sustainability indicator that can meet all of the criteria simultaneously. In such a case, Maclaren (1996a) suggested that decisions should be made about the relative importance of the criteria.

Collect data and propose final set of indicators

This step is the most time intensive in the indicator selection process. Indicators depend greatly on the quality and availability of data. Some indicators may be derived from existing reports while others need to be collected from scratch. In other cases, indicators may prove immeasurable. Due to this complexity, the set of indicators should be thoroughly reviewed to ensure their acceptability.

Prepare and report indicators

Rather than simply to measure progress towards sustainable development, indicators must be communicated to their intended audience. This step serves the overall purpose of indicator development. Sustainability reporting should be in such a form that would make indicators easily understandable and recognizable. Sustainability indicators could be developed as numbers and graphic representations to be able to convey their real meaning for everyone.

The development of sustainability indicators raises questions about how much information is adequate and relevant. Ruitenbeek (1991) suggested that few data which are “crude and available now” are better than having a lot of data which are “precise but available later”. Very detailed information can be confusing and may restrain people’s ability to make conclusions. On the one hand, if not all types of information are

collected, too much focus on one kind may lead to wrong policy decisions. Ruitenbeek also noted that providing explanations on what the indicators mean helps educate the target audience.

3.3 Synthesis

While the economic and social indicators of development have been fully developed and adopted since early periods, comparable measure for environment has lagged behind. Growing concern on the broader impact of development in the environment has brought an urgent call for developing a range of indicators that capture economic, social, and environmental factors. The sets of indicators developed by communities may vary but they are guided by a common ethic that the Earth has a limited supply of natural resources.

Access to relevant information is a key for making and measuring progress towards sustainability. From this information, appropriate indicators of sustainability can be developed. The design of indicators is sensitive to how these indicators will be used and who will be using them. Carefully selected indicators based upon general criteria provide planners and decision-makers a sound basis for formulating and implementing appropriate policies and action plans and captivate public's attention and support.

An indicator can be an appropriate measure of a community's sustainability if it possesses the properties mentioned in section 3.1.3 and meets as many as the criteria described in section 3.1.4. The rating scheme developed by Hart (1995) presented in Table 2 can be a useful tool in determining whether indicators are poor or good measures

of sustainability by quantifying the otherwise qualitative properties and criteria mentioned above.

Hart intentionally omitted the perfect score of 10 “*to emphasize the idea that sustainability is something we strive for, but which may not actually be achievable.*” This scheme was used in the next chapter to assess the indicators chosen by Santa Monica, Seattle, Olympia/South Puget Sound, Jacksonville, Boulder, and San Francisco.

Table 2. Ranking Scheme for Sustainability Indicators

Scores	Rating	Characteristics
1 to 3 points	Poor	• Emphasis on control of problems, without pointing in direction of solutions • Measure of a problem or symptoms of a problem, without pointing in direction of solutions • One-dimensional measures – no links to other areas • Difficult to understand • Emphasis is on short term effects (< 10 years) • Emphasis is on growth, particularly without regards to limits
4 to 6 points	Good	• Two-dimensional measure that links at least two categories • Forward looking, longer range focus (10-20 years) • Suggest possible solution to problems • Measure an underlying problem that causes other problems • Measure diversity • Concerned with amounts of resources consumed, not just the after-effect of consumption • Simple and easy to understand • Emphasis on local sustainability that does not detract from global sustainability
7 to 9 points	Very good	• Multi-dimensional measures – links two or more categories • Forward looking, long range (20-50+ years) • Emphasis on local wealth, local resources, local needs • Emphasis on appropriate levels and types of consumption • Easy to understand and display changes • Reliable, accurate, frequently reported data is readily available • Reflect local sustainability that enhances global sustainability

Source: Hart, M. (1995, May). *Guide to Sustainable Community Indicators*. Massachusetts: QLF/Atlantic Center for the Environment.

CHAPTER 4

An Analysis of Sustainable Community Indicators Projects

As it was concluded in the previous chapter, indicators of sustainability serve a variety of purposes to different communities. Effective indicators can be valuable tools for many planning activities, such as policy evaluation and recommendations, public education, and performance evaluation. Indicators can give insights on the trends that are driving the need for a particular community action, for instance, rezoning decision (Redefining Progress, 1997). Awareness inculcated by indicators can stimulate action and changes in behavior. Also, indicators help assess progress in the attainment of sustainability goals, providing a picture whether a community is moving away or towards its targets.

This chapter profiles six sustainability indicators projects in the United States: Santa Monica Sustainable City Program (Santa Monica, California), Sustainable Seattle (Seattle, Washington), Olympia/South Puget Sound Sustainable Community Roundtable (Olympia, Washington), Life in Jacksonville (Jacksonville, Florida), Boulder County Healthy Communities Initiative (Boulder, Colorado), and Sustainable San Francisco (San Francisco, California). These particular projects were selected because of their urban focus and their illustration of the different themes underlying the development of indicators. Further, they were chosen to exemplify the different factors that stimulated communities to undertake sustainability program and develop their own indicators, the

steps undertaken for developing indicators, the wide array of indicators identified by the communities, and the range of uses of these indicators to a particular community.

This chapter presents an overview of the six sustainability projects. In addition, a comparative analysis was drawn along the major aspects underlying the development of indicators, such as definition of sustainability, types and properties of indicators, participants, target audience, criteria in selecting indicators, and reporting of indicators. In order to find the indicators commonly used by urban communities, indicators were grouped according to categories and subcategories that represent them using the classification provided by Hart (1995). Also, the quality of indicators as appropriate measures of sustainability was evaluated applying Hart's ranking scheme as presented previously in Table 2.

4.1 Background

The sustainable development initiatives undertaken by the six communities are briefly discussed to provide an insight on what were the concerns of the communities, when and how the projects evolved, and who were involved. This information is summarized in Table 3.

4.1.1 Santa Monica Sustainable City Program

In 1991, the Santa Monica City Council created an advisory body called the Task Force on Environment to review the city's current environmental policies and programs.

**Table 3. Selected Indicators Projects
Background Information**

	Santa Monica Sustainable City Program	Sustainable Seattle	Olympia/South Puget Sound Sustainable Community Roundtable	Life in Jacksonville	Boulder County Healthy Communities Initiative	Sustainable San Francisco
Geographic scope	City	City/county	City/county/region	City/county	County/region	City
Date initiated	1991	1990	1991	1985	1994	1993
Main theme	Environmental quality	Long-term sustainability (social, environmental, and economic concerns)	Social, environmental, and economic	Quality of life	Healthy community and quality of life	Environmental quality and quality of life
Motivation	A desire to efficiently and effectively coordinate the City's environmental programs.	Ensuring that the community they pass on their descendants will be healthy, vital, and fulfilling.	A longing for a greater "sense of community" and defining what it would take to become a sustainable city.	A need for community improvement.	A recognition that some form of regional planning was necessary if the quality of life was to be sustained for all county residents	A need to improve the City's environmental practices in order to sustain the quality of human life and the ecological health and biodiversity of the region for the next generations.
Responsible agency	Task Force on the Environment and City Council	Sustainable Seattle	Sustainable Community Roundtable	Jacksonville Community Council, Inc., Jacksonville Chamber of Commerce,	Boulder County Healthy Communities Initiative	San Francisco Commission on the Environment, Sustainable San Francisco
Community input	Yes	Yes	Yes	Yes	Yes	Yes
Overall goal of the program	To create the basis for a more sustainable way of life through the safeguarding and enhancing of resources and by preventing harm to the natural environment and human health.	To develop a set of sustainable community indicators to assess progress toward (or away from) long-term sustainability, identify key steps the community can take to improve progress, and make these changes real.	To coordinate a region- wide educational process and embarked on an internal process using sustainability as a theme for policy-making and employee education.	To monitor community performance and use indicators as a tool to help in building a sustainable future for the community.	To identify major trends and implement positive change on issues that will affect the long-term health and quality of life in the county.	To develop a prosperous and healthful urban system which can provide for the physical and other needs of the population while reversing the trends of increasing pollution and environmental degradation now threatening the quality of urban life.
Status of indicators	Operational	Operational	Operational	Operational	Under construction	Under construction

The Task Force is composed of seven local professionals with expertise in urban planning, sustainable building design, hazardous waste management, energy, water quality and environmental health, policy, and education. Recognizing the need to efficiently coordinate the city's environmental programs, the Task Force identified sustainability as a fundamental vision to guide the city's operations.

In 1992, the Task Force, in cooperation with city staff from the Department of Environmental Works and Public Management, started to develop the Santa Monica Sustainable City Program to address the root causes of environmental problems and to provide criteria for evaluating long-term rather than short-term impacts of decisions. Through mailed questionnaires, the Task Force surveyed citizens and community leaders including members from the City Council, city departments, Housing and Planning Commissions, and Chamber of Commerce Environment Committee on local environmental issues and their perception of how effective the city was responding to these issues. A series of meetings and workshops were held with more than a hundred individuals in attendance. Facilitated discussion groups encouraged participants to evaluate and provide input on the draft program.

The City Council officially adopted the Santa Monica Sustainable City Program in September 1994. The Program focuses on four major policy areas, namely: resource conservation, pollution prevention and public health protection, transportation, and community and economic development. Specific goals and targets for the year 2000, with reference to 1990 baseline data, were established for each policy area to assess the effectiveness of the program with regard to sustainability. A total of 18 indicators were developed as a means to measure progress towards meeting the goals.

The Environmental Programs Division (EPD) of the Department of Environmental and Public Works Management coordinates and implements the Sustainable City Program. An implementation strategy serves as a guideline in translating the concepts of the program into practice. The EPD reports on the program's progress at monthly meetings of the Task Force. The Task Force's first Sustainable City Progress Report was submitted to the City Council in December 1996. Copies of the report were also disseminated to the news media, businesses, and residents. The Task Force's biannual report is intended to evaluate the city's performance towards attaining sustainability goals and to spur actions and interest in sustainability from all sectors of the community.

4.1.2 Sustainable Seattle

Concerns about the future of the economic health of the community, environment, and the overall quality of life of its citizens, spurred action from a group of individuals to promote the concept and practice of sustainability in the area. After attending a conference on sustainability in late 1990, volunteers from different sectors of the community led the process of developing sustainability indicators for Seattle. The group was later formed as a nonprofit organization named Sustainable Seattle.

Sustainable Seattle began with promoting awareness about the project and identifying leadership and support. The group conducted civic forums to define the problems and address the concerns of the community. After several months, Sustainable Seattle volunteers arrived at a consensus of what sustainability means to them and for the

community. Sharing a common vision of “ensuring that the community pass on to their descendants will be healthy, vital, and fulfilling,” Sustainable Seattle defined sustainability as a “long-term health and vitality—cultural, economic, environmental, and social.”

A civic panel process was adopted to identify the best indicators of sustainability for Seattle. The process brought together hundreds of active citizens in Seattle. Through a series of meetings and workshops, 40 sustainability indicators were identified and selected for research and publication. These indicators were categorized into environment, population and resources, economy, youth and education, and health and community.

Several individuals from local government, academic, businesses, and research groups cooperated to collect the data. After the data had been gathered and analyzed, Sustainable Seattle packaged the information into an understandable format for use by the media and the general public – not only to communicate the information but also to stimulate action. The Sustainable Seattle: Indicators of Sustainable Community, published in 1993, contains 20 indicators. Additional 20 indicators were included in the second publication in 1995.

4.1.3 Olympia/South Puget Sound Sustainable Community Roundtable

Faced with the challenges of rapid urbanization which affect not only the natural environment but also the social and economic environments, the city of Olympia and neighboring cities around South Puget Sound, Washington, initiated a Sustainable

Community Roundtable in 1991. The Roundtable was incorporated as a nonprofit organization in 1992. It uses "innovative participatory process" to encourage sustainability as a theme for policy-making and public education in the region. The Roundtable was commended by the American Planning Association and the Planning Association of Washington in 1993 for its works with individuals, governments, businesses, and civic organizations to integrate planning and action around social, environmental, and economic issues (Sustainable Communities Network, Online).

The Roundtable's first approach in promoting awareness of the concept of sustainability was in 1991 via its newsletter mailed to local citizens. In 1993, a sustainable city principle was adopted. This principle acknowledges the city's responsibility for leadership in creating a sustainable community—locally, regionally, and globally and defines a sustainable community as "one that persists over generations and is far-seeing enough, flexible enough, and wise enough to maintain its natural, economic, social, and political support systems."

The Roundtable publishes the State of the Community report which serves as an avenue for involving individuals and organizations in its effort towards the realization of how they want their community to be in the future. The first report was published in 1993 and copies were mailed to hundreds of citizens and distributed at community gatherings. The report sparked considerable interests as evident from participation of about 200 citizens in public discussions, workshops, and roundtables.

An 18-month review process undertaken to discuss the specific chapters in the 1993 report and improve the community indicators resulted in the publication of the second edition of the State of the Community Report in 1995. The categories chosen to

assess the sustainability of the region are resource consumption, natural environment, economy, social equity and justice, education and culture, health, transportation, housing, governance, population, and spirituality. Each category addresses the vision, the current reality, the 13 indicators, and the next step towards the sustainability goals.

4.1.4 Life in Jacksonville

The Quality-of-Life project evolved from a strong motivation for community improvement in the City of Jacksonville, Duval County, Florida. The project began in 1985 with the involvement of more than 100 volunteers under the leadership of a nonprofit organization, Jacksonville Community Council, Inc. (JCCI) and in consultation with the Chamber of Commerce. The group developed a quality of life model, composing of nine elements as: (1) education (2) economy (3) public safety (4) natural environment (5) health (6) social environment (7) government and politics (8) culture and recreation (9) mobility. Specific indicators were developed for each area to reflect changes in the community's quality of life. Since then, each year, a participatory process is led by JCCI to discuss community issues. JCCI promotes open dialogue and consensus building in its effort to improve the quality of life in the city of Jacksonville and Duval County, Florida.

In 1991, JCCI collaborated with the Chamber of Commerce and the city of Jacksonville for the Targets 2000 project. The project underwent a strategic planning process in which about 140 volunteers reviewed the indicators, ranked them according to level of importance for community action, and set targets for the year 2000. The purpose

of the project is to make citizens more aware of important aspects of their quality of life, so that "they can be proud of the positives and seek ways to improve on the negatives."

An annual report, *Life in Jacksonville: Quality Indicators for Progress*, contains 72 indicators which reflect trends starting with 1983. Positive trends are highlighted with gold stars while negative trends are indicated with red flags. Most of the data were obtained from existing public sources, but several came from a random, telephone survey. The report is widely used by public and private decision-makers in Jacksonville to inform strategic planning and to guide policy making. It also increases public knowledge and awareness about important aspects of the community.

4.1.5 Boulder County Healthy Communities Initiative

Recognizing the need for a more effective regional planning to sustain the quality of life of all county residents, 38 eight leaders of Boulder County created a committee in 1994 to apply for a planning grant from the Colorado Healthy Communities Initiative. The approval of the request resulted in the implementation of the Boulder County Healthy Communities Initiative (BCHCI) in 1995. The BHCI aims to identify major trends and act on issues that will affect the long-term health and quality of life in Boulder County, Colorado.

A group of about 120 people from different sectors of the community worked in defining a vision for the county, finding a set of regional indicators, and developing an action plan to achieve the sustainability goals. Monthly meetings in which public participation was encouraged were held until early 1996. In the first meeting held in May

1995, participants were asked about their values and visions for a healthier community. Their inputs were consolidated into ten themes as: (1) education (2) environment (3) health and wellness (4) arts and culture (5) transportation (6) business and economy (7) children, youth, elders, and families (8) housing (9) leadership and government, and (10) neighborhoods.

After two years, the Boulder County Healthy Communities Initiative has identified 41 indicators depicting the sustainability themes for the county. Data gathering for these indicators is in progress. Data have been collected for twenty-three indicators while data for the other eighteen are still being worked out. The BCHCI plans to publish its first report card in early 1998. The Project Administrator of BCHCI, Susan Foster, stressed that the Boulder County's sustainability indicators, as discussed in this chapter, might still undergo some revisions as a result of public review and comments.

4.1.6 Sustainable San Francisco

The residents of the city of San Francisco, California recognized that its environmental practices could not sustain the quality of human life and ecological health and biodiversity of the region. In 1993, the San Francisco Commission on the Environment spearheaded a collaboration of individuals and organizations to develop a sustainability action plan that addresses San Francisco's long-term environmental sustainability. The commission formed a coalition of over 400 volunteers representing the city government, environmental advocacy groups, community groups, and businesses. This coalition is called Sustainable San Francisco. Sustainable San Francisco began with

a review of sustainability plans done nationally and internationally and build on models proved to be successful.

The Sustainability Plan for the City was adopted by the San Francisco Board of Supervisors in July 1997. The plan contains a broad range of topics such as: (1) agriculture (2) air quality (3) economy and economic development (4) energy, climate change, and ozone depletion (5) environmental justice (6) hazardous materials (7) human health (8) municipal expenditures (9) open space: inland lakes and streams, natural habitat and biodiversity (10) open space: parks, public spaces, and the streetscape (11) public information and education (12) risk management (13) solid waste (14) transportation, and (15) water and wastewater. Sustainable San Francisco reasoned that it is essential to address these areas specifically because of the cross-cutting effects of several areas.

For each of the 15 areas, the plan establishes the long-term social goals, short-term objectives (for the year 2001), long-term objectives (to reach sustainability), specific actions that individuals, businesses, and city government can take to achieve these goals, and 86 indicators for assessing whether the goals have been achieved or not.

The development of indicators for the city is still in its infancy. Janet Jacobs, Sustainable San Francisco Director, mentioned that some baseline data have already been collected but there is no definite plan yet on the compilation of information into a report.

4.2 Issues in Developing Indicators of Sustainability: Comparative Analysis of Selected Projects

The main issues considered in this analysis are the definition of sustainability, types and properties of indicators, participants in the identification of indicators, target audience, and the criteria used in the selection of indicators. Other relevant issues that affect the role of indicators projects in the development and implementation of effective policy and planning decisions at the local level are also evaluated. All these issues form the general framework underlying the development of indicators presented in Table 4.

4.2.1 Definition of Sustainability

The definition of sustainability forms the basis of the types of indicators selected by the communities. It was also noted that sustainability has been defined by these communities based on their overall goal (refer to Table 3). Santa Monica, Boulder, and San Francisco have chosen to adopt directly the definition given in the Brundtland report, which is “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” Although Seattle and Olympia have defined sustainability in different manners, their definitions convey most of the sustainability characteristics embodied in the Brundtland definition. Jacksonville’s quality-of-life is a concept closely related to sustainability because a sustainable community is all about quality of life. In general, all these six communities have

Table 4. Selected Indicators Projects General Framework

	Santa Monica Sustainable City Program	Sustainable Seattle	Olympia/South Puget Sound Sustainable Community Roundtable	Life in Jacksonville	Boulder County Healthy Communities Initiative	Sustainable San Francisco
Definition of sustainability	The ability of a community to meet its current needs without compromising the ability of future generations to meet their needs.	Long-term health and vitality—cultural, economic, environmental, and social.	A sustainable community is one that persists over generation and is far-seeing enough, flexible enough, and wise enough to maintain its natural, economic, social, and political support systems	Quality of life refers to a feeling of well being, fulfillment, or satisfaction resulting from factors in the external environments.	A healthy community is one that is meeting the needs of the present without compromising the ability of future generations to meet their own needs.	Sustainability is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
Classification of indicators	Resource conservation; transportation; pollution and public health protection; community and economic development	Environment; population and resources; economy; youth and education; health and community	Natural environment; population; resource consumption; transportation; housing; economy; social equity and justice; education; health; governance	Education; economy; public safety; natural environment; health; social environment; government politics; culture/recreation; mobility	Education; environment, health and wellness; arts and culture; transportation; business and economy; children, youth, elders, and families; housing; leadership and government; neighborhoods	Agriculture; air quality; economy and economic development; energy, climate change, and ozone depletion; environmental justice; hazardous materials; human health; municipal expenditures; noise; natural habitat and biodiversity; parks, open spaces, and streetscape
# of specific indicators	18	40	13	72	41	86
Targets/reference point	Yes (all)	Yes (few)	Yes (few)	Yes (all)	N/A	Yes (all)
Baseline/year	Yes/1990	Variable	Variable	Yes/1983	N/A	N/A
Participants in the development of indicators	Volunteer Citizen Task Force, City Council, city departments, and citizens	Sustainable Seattle Network, Civic Panel consisting of business leaders, environmental groups, city and county governments, interest groups, educators.	Sustainable Community Roundtable, community members, businesses, civic and government organizations	Jacksonville Community Council, Inc., Jacksonville Chamber of Commerce, City and municipal governments and agencies, citizens	County residents from public and private organizations representing business, education, environment, arts, the media, health and human services, and religious institutions	Commission of San Francisco's Environment, Sustainable San Francisco, City Planning Department, citizens

Table 4 (continued)

	Santa Monica Sustainable City Program	Sustainable Seattle	Olympia/South Puget Sound Sustainable Community Roundtable	Life in Jacksonville	Boulder County Healthy Communities Initiative	Sustainable San Francisco
Purpose	To evaluate city performance and spur actions.	To guide change.	To report progress and suggest next steps for the community and individual citizens. To guide city policy and budget decisions.	To monitor progress.	Public involvement and education, shape policy options for a healthy future.	To assess progress
Intended main audience	City Council and city agencies	General public and media	General public	Citizens, local governments, planners, media, business and community organizations, foundations	General public	General public
Criteria used in selection of indicators	- Fundamental to the long-term economic, environmental or social health of the community - Statistically measurable - Represents something that can be influenced by community or government actions	- Bellwether tests of sustainability - Accepted by the community - Attractive to local media - Statistically measurable - Logically or scientifically defensible	- Relevance to sustainability - Of interest to diverse group of individuals - Data availability	- Validity - Availability and timeliness - Stability and reliability - Understandability - Responsiveness - Policy relevance - Representativeness	- Reliability - Validity - Sensitivity to change - Accessibility - Policy relevance - Understandability - Political considerations	- Obvious in what is being measured - Can be found at low cost given the current information-gathering machinery - Clearly indicate a trend toward or away from sustainability - Understandable to the general public and easily presented to the media
Report/Frequency	Sustainable City Progress Report (1996); biannual	Indicators of Sustainable Community report (1993 and 1995); biannual	State of the Community report (1995); biannual	Life in Jacksonville: Quality Indicators for Progress (since 1986); annual	Report card (none available yet); perhaps annual	Report card (none available yet); perhaps annual

incorporated into their definitions and goals the core principles of sustainability which are long-term vitality and intergenerational equity.

Some important findings and conclusions derived from the analysis include:

- The absence of a standard definition of sustainability is seen as positive because sustainability, as it should be defined, represents the values of the community.
- Defining sustainability is the cornerstone in the indicator development process because it establishes the scope of the indicators.
- The involvement of the public in the process is a worthwhile endeavor because it educates the community and its leaders along the process and it promotes ownership and awareness about the program.

4.2.2 Classification of Indicators

There is a wide variation in the way communities classified their indicators. However, no matter how indicators were classified, the categories used by each community embody the broad spectrum of sustainability. The most common categories are natural environment, economy, resource use, transportation, and health. The number of categories ranged from 4 for Santa Monica to 16 for San Francisco.

Again, the classification of indicators relates to the sustainability goals defined by communities. The Santa Monica project, whose main theme is environmental integrity, identified indicators that are linked to the city's environmental quality. Jacksonville is

concerned about quality of life, therefore, Jacksonville's indicators harness the citizens' concerns about their socio-economic and natural environment. The indicators of Boulder, which are very much similar with that of Jacksonville, reflect the overall health of the community. Most of the indicators identified by Jacksonville and Boulder are related to social and institutional services, such as education, health, and government.

San Francisco has the most number of indicators, disaggregated into sectors. For example, other communities include water and energy consumption under the resource use category. For this matter, San Francisco identified energy, climate change, and ozone depletion, and; water and wastewater. San Francisco is the only one among the six communities to have identified indicators for "noise" pollution.

Some important findings and conclusions derived from the analysis include:

- There is no rule as to how indicators should be classified or how many indicators are adequate.
- Different communities use different terminologies and methods in classifying their indicators.
- Regardless of the categories used by the six communities, indicators of sustainability generally encompass the broad social, economic, and environmental aspects of the community.
- In selecting indicators of sustainability, it should be kept in mind that too much or too little information may inhibit the usefulness of indicators.

4.2.3 Properties of Indicators

Some experts suggest the use of forward-looking indicators to measure progress towards achieving intergenerational equity, which is a basic principle of sustainability. It should be emphasized that, to enforce the forward-looking ability of indicators, they should be related to specific reference values, targets or benchmarks.

Santa Monica, Jacksonville, and San Francisco are considered forward-looking indicators as they are clearly linked to desired conditions at a certain period of time. Santa Monica's and Jacksonville's indicators relate the community's actual condition to a desired state by the year 2000. San Francisco identifies short- and long-term objectives to establish a set of forward-looking indicators.

Seattle uses reference values for indicators of housing affordability, children living in poverty, air quality, and low birthweight infants. Olympia has adopted the definition of "living wage" used by the State Department of Community, Trade, and Economics in order to measure whether the economy is meeting people's needs.

Boulder is still in the process of refining its indicators and, thus has not yet established any targets or reference points.

Many of the indicators identified by the six communities establish linkages among the economic, environmental, and social aspects of sustainability. Sustainable Seattle provides good examples of these linkages, most popular of which is the wild salmon runs which is linked to the economy – tourism, recreation, and food production – as well as environment (Sustainable Seattle, 1995).

Some important findings and conclusions derived from the analysis include:

- A community can better gauge how far it is from its sustainability goals if indicators are tied with well-defined, measurable reference values.
- A sustainable community is a network of interrelated, complex systems – social, economic, and environmental. Thus, sustainability indicators should not merely show data but also reflect linkages among various trends in these systems.

4.2.4 Participants in the Indicators Identification Process and Target Audience

The Santa Monica Sustainable Community Program which is led by a City-Council appointed Task Force is more of a government-based approach that places little emphasis on community involvement. Its advantage is that a strong government support has facilitated the implementation of programs necessary for attaining the city's sustainability goals.

The projects of Seattle, Olympia, Jacksonville, Boulder, and San Francisco exemplify multi-stakeholders involvement early on the decision-making processes. Seattle's was the only project initiated by a group of volunteers rather than by a formal organization. The Olympia/South Puget Sound Sustainable Community Roundtable, Boulder County Healthy Communities Initiative, and Sustainable San Francisco emerged from motivation of city leaders but strongly encouraged community involvement in a

number of activities. The nonprofit organizations responsible for developing the sustainability program were subsequently formed.

The Jacksonville's quality-of-life project was an initiative of a nonprofit organization that greatly promoted public participation. Its partnership with the Chamber of Commerce from the initial phase of the project is also a significant aspect of the project.

All the communities except Santa Monica have targeted the general public as the main audience for their indicators. Santa Monica's motivation for the development of indicators is to coordinate the city's environmental programs. Thus their indicators serve primarily the city agencies so that city operations will be improved and necessary actions will be carried out for the benefit of the entire community. All the other five projects are focused on promoting the practice of sustainability therefore the target audience is the community as a whole.

Some important findings and conclusions derived from the analysis include:

- Sustainability offers a great opportunity for community involvement and visioning.
- The involvement of diverse stakeholders is very important in identifying good indicators. This would ensure that both the interests of the public, government, and business sectors are well considered.
- Sustainability indicators can serve a variety of purposes which altogether sum up to addressing the concerns of the community now and in the future.
- The selection and design of sustainability indicators take account of the audience for which they are intended so as to ensure action towards sustainability.

4.2.5 Criteria Used in Selecting Indicators

It is important to establish a set of criteria in identifying indicators of sustainability. The list provided in Chapter 3 might not be comprehensive but adequate for use in selecting appropriate set of indicators of urban sustainability. Based on such list, analysis of the six communities showed that representativeness, policy relevance, measurability, and understandability are the most commonly used criteria. Santa Monica and Seattle emphasized that indicators should be tests for long-term sustainability. Interestingly, the attractiveness of indicators to the local media is a concern for Seattle, which indeed is crucial in communicating the indicators to the public.

Boulder is the only community that explicitly mentioned political considerations as a criterion. Gaining wide political support is important for the success of an indicators project in terms of implementation and financial assistance. None of the communities used indicators that are comparable with other geographic areas.

Some important findings and conclusions derived from the analysis include:

- It is deemed impossible to arrive at a set of indicators that meet all the selection criteria. An indicator that a community considers very important should not be excluded on the basis of not meeting an essential criterion.
- Community participation is again crucial in this stage of indicator development process.
- The target audience and the purpose for indicator development determine which criteria are important.

4.2.6 Reporting of Indicators

Santa Monica, Seattle, and Olympia publish biannual report to communicate the indicators to their intended audience. Jacksonville's reporting is annually. Boulder expects to come out with its first report card in 1998. As mentioned earlier, the San Francisco's indicators project has not yet been fully realized. In the process, information about the sustainability initiative is disseminated through its quarterly newsletter.

Some important findings and conclusions derived from the analysis include:

- All the efforts invested in the processes of visioning and developing indicators would be futile if the results are not properly communicated.
- Regular updating of report is crucial for assessing the community's condition.
- The indicator report should be simple and clear to be able to convey necessary information.

4.2.7 Data Sources and Cost

Many of the indicator reports do not include information about their data acquisition. However, it was noted that in general, data for indicators are collected from various local and government agencies, nonprofit organizations, and some entities like the utility company. Qualitative data are gathered through telephone or mail surveys.

Some businesses also provide data collection service with fee. Undoubtedly, data collection can be tedious and costly.

Some important findings and conclusions derived from the analysis include:

- As much as possible, indicators should use readily available data.
- The validity and reliability of information are important for indicators to serve their purposes.

4.2.8 Action from Indicators

Sustainable Seattle's Indicators of Sustainable Community has been linked to several planning projects in the area. One remarkable outcome is its usefulness in the updating of the city's Comprehensive Plan.

The Santa Monica Sustainable City Program has been guided by a set of principles which emphasize the strong commitment of the city to the implementation of environmental programs that reduce or eliminate negative environmental impacts. One of its activities was the creation of the Household Hazardous Waste Consumer Awareness Ordinance or the Labeling Ordinance which aims to discourage dumping. In its 1996 report, the Task Force on Environment has made a recommendation to incorporate the Sustainable City Program in the city's General Plan.

Similarly, the Olympia Sustainable Community Roundtable has resulted in the implementation of many activities such as developing land use and transportation

strategies and planning in advance for public services and utilities to serve the increasing population (Sustainable Communities Network, Online).

In Jacksonville, the Quality Indicators for Progress report has been useful to many individuals and organizations. For example, when water quality indicators exhibited a decreasing trend from 1983 to 1987, a city-wide campaign was conducted to encourage actions from citizens in order to reverse the decline. Also, a decrease in high school graduation rates from 1984 to 1989 resulted in a program called "Cities in Schools" in which local citizens and businesses cooperated with school personnel, students, and parents to improved educational performance (Ibid, Online).

The indicators projects of Boulder and San Francisco have just started therefore, no result can be reported yet. However, their sustainability programs have already gained considerable interests and support from the communities. Boulder is now working on building a community center on a 25-acre property where people can gather and participate in community planning and public dialogue. In San Francisco, several groups have begun the implementation of the actions and projects recommended in the Sustainability Plan. A solid waste management program is currently undertaken to educate consumers about recycled packaging and bulk purchases. A non-profit organization helps in planting trees around the city in order to meet the target of 4,000 trees per year.

Some important findings and conclusions derived from the analysis include:

- Indicators promote a concerted effort in establishing a sustainable future for a community.
- Indicators help in the implementation of specific projects at a practical planning level.
- Many of the indicators projects are still in their early stage and, thus outcomes are not yet visible. However, the communities' sustainable development programs in its entirety have demonstrated remarkable results.

4.3 The Selected Indicators of Sustainability

This section discusses the remaining analyses of the six sustainability indicators projects. These analyses aim to identify what are the commonly used indicators in the six communities and which among these indicators represent “good” measures of sustainability.

4.3.1 Common Indicators

The indicators identified by each community were grouped according to indicators category and subcategory compiled by Hart (1995). It should be emphasized, however, that this grouping, as shown in Table 5, does not imply that communities are using exactly the same measure for each category and subcategory. A comparison was

Table 5. Commonly Used Indicators

	Santa Monica	Seattle	Olympia	Jacksonville	Boulder	San Francisco
Economy						
Business activity				x	x	
Children in poverty				x		
Diversity in the workplace						
Employment		x	x	x	x	x
Local food production			x			x
Housing availability				x		
Income		x		x	x	
Innovative capacity						
Resource use				x		x
Sales				x		
Savings		x				
Service accessibility						
Small Business						
Tourism						
Training opportunities						
Education						
Adult life long learning					x	
Children attendance and preparedness		x		x	x	x
Cost				x		
Racial and ethnic diversity		x		x		x
Employment support						
Literacy		x	x			
Post-secondary				x		
School infrastructure and curricula	x		x			x
Skills achievement				x	x	x
Teacher sufficiency and preparation				x	x	
Training programs						
Volunteer programs to support schools		x				
Youth attitudes					x	x

Table 5 (continued)

	Santa Monica	Seattle	Olympia	Jacksonville	Boulder	San Francisco
Environment						
Air quality		x		x	x	x
Awareness						x
Biodiversity		x				x
Drinking water	x				x	x
Fish populations		x				x
Forest health						
Groundwater	x			x		
Hazardous waste clean-up	x					
Land use	x	x	x		x	x
Noise reduction						x
Soil erosion		x				
Surface water quality				x		x
Visual landscape				x		
Wetlands		x				x
Government						
Diversity and foreign language use				x		
Effectiveness						
Inter-government cooperation					x	
Leadership				x		
Model role	x					x
Participation and civic involvement		x	x	x	x	
Services provision				x		x
Tax revenues					x	
Health						
Access to care		x				
Health care expenditure		x				
Disease incidence			x	x		x
Drug use				x		x
Fitness						x
Infant mortality				x	x	
Insurance				x	x	
Mortality				x	x	x
Pregnancy/Birth		x		x	x	x
Safety hazards				x		
Service quality				x		
Housing						
Independent adult/senior citizens						
Availability			x		x	
Condition						
Cost	x	x		x	x	
Expenditures						
Homelessness		x				
Ownership						

Table 5 (continued)

	Santa Monica	Seattle	Olympia	Jacksonville	Boulder	San Francisco
Population						
Demographics		x	x		x	
Diversity						
Public Safety						
Accidents				x		x
Civil Emergency response						x
Crime incidence & neighborhood watch			x	x	x	x
Domestic violence						x
Drug incidence and prevention						
Juvenile crime		x	x			
Traffic accidents and law enforcement						x
Violence					x	
Recreation						
Accessibility				x		
Land use	x			x	x	x
Resource Use						
Energy	x	x	x		x	x
Hazardous materials	x					x
Hazardous waste generation	x	x				x
Recycling/reuse	x	x			x	x
Sewage and wastewater reduction	x					x
Solid waste generation	x	x	x	x	x	x
Water	x	x	x	x		x
Society						
Abuse of vulnerable groups				x		
Child support and care					x	
Connectedness	x	x			x	
Culture and arts exposure		x		x	x	x
Diversity and discrimination				x		
Mental health						
Teen pregnancy				x	x	
Social and environmental equity					x	
Volunteerism		x		x	x	
Transportation						
Air traffic				x		x
Bicycle					x	x
Commute	x			x	x	
Cost						
Infrastructure						
Land use for streets						
Public transit	x			x	x	x
Vehicle use and fuel type	x	x	x		x	x

performed primarily to identify commonly used indicators of sustainability. Analysis showed that Santa Monica's indicators are focused on environmental and resource use. All the other five communities have covered almost all of the indicator categories although in varying extents. For example, Olympia has captured all the categories except "society" (which presumably overlaps with other categories such as public safety) with its 13 indicators; whereas, San Francisco, which has the most number of indicators, has identified many specific indicators for each category. Given below are the dominant indicators per category in the six communities:

- Economy: Employment indicators are being used as measures of economic vitality in five communities.
- Education: Children attendance and preparedness indicators were noted in four communities. The indicators under this category emphasize the readiness of children to enter the different education levels.
- Environment: Four communities identified land use indicators to characterize environmental balance and integrity. Land use indicators measure the community's health with regard to the proportion of natural areas preserved in natural developments.
- Government: Participation and civic involvement stands out in this category.
- Health: Pregnancy/birth indicators rank the highest in this category.
- Housing: Cost is the most useful indicator of housing.
- Population: Three communities identified demographic indicators.

- Public Safety: Crime incidence is the most widely used indicator to emphasize safety and security in the community.
- Recreation: Land use indicators were recognized as good measures of the recreational amenities available in the community.
- Resource Use: This item came out to be the most outstanding of all the indicator categories. Indicators of solid waste generation were noted in all the six communities. Indicators of energy use, water consumption, and recycling/reuse were also prominent under this category.
- Society: Culture and arts exposure indicators are the most popular in this category.
- Transportation: Vehicle use and fuel type indicators appear to be the most common, followed by public transit

Surprisingly, only the indicators of solid waste generation are common in all the six communities. Indicators of employment, energy use, water use, and vehicle use/fuel type were noted in five communities. Four communities are using indicators of children attendance/preparedness, land use, participation and civic involvement, housing cost, crime incidence and neighborhood watch, recycling and reuse, culture and arts exposure, and public transit.

The results show commonality among indicators which underscores the fundamental characteristics of a sustainable community. In addition to this commonality, the results also demonstrate the uniqueness of indicators in each community and the variations in which specific indicators are defined and classified by communities. The

findings reiterate that indicators are not merely adopted based on experiences of others but rather they are carefully identified and selected by the community itself based upon its established goals and targets.

4.3.2 Rating of the Indicators

The specific indicators selected by each community were further assessed for its appropriateness as measures of sustainability. Based on the ranking scheme developed by Hart (1995), as presented in Chapter 3, the indicators were assigned scores to evaluate whether they are “poor” or “good” indicators of sustainability. The rank ranges from 1 to 9 where a score of 1 denotes a poor indicator of sustainability and 9 means a very good indicator of sustainability.

The scores for the majority of the community indicators are based on Hart’s examples. The ratings given by Hart are consistently low, which underscores the fact that ratings are subjective and could have inherent bias. Considering that there will always be a bias in any ranking scheme, this research opted to keep Hart’s scheme. It should be emphasized, however, that what is relevant is the internal consistency. Ratings only provide ordinal levels of measurement. Thus, the only valid information derived from them is some measure of their quality relative to one another. For example, ratings indicate that the indicators selected by Santa Monica are generally of better quality than those of Jacksonville.

The rating for each of the specific indicators used by the six communities is presented in Appendix A. In addition to Hart’s rating approach, this research also used a

mean as a composite measure to show overall quality of the indicators as shown in Table 6. As a result, the Santa Monica indicators emerged as the highest with an average score of 4.4, followed by Boulder and San Francisco with a score of 4.0. Olympia and Seattle followed closely with a score of 3.9 and 3.8, respectively. Boulder got 3.6 points while Jacksonville came out with a score of 3.2.

Santa Monica, with its focus on environmental integrity, seems to have carefully selected their indicators based upon a set of significant criteria. The high score can be attributed to indicators which characterize human impacts on the environment and those that measure gains, for example, the reduction of solid waste that goes to landfill through recycling and the use of recycled paper in many city agencies.

The Life in Jacksonville project scored the lowest among the six communities under study. The low score could be attributed to the fact that: (1) Jacksonville's quality-of-life indicators include many traditional indicators, i.e., achievement test scores and net job growth, and put little emphasis on the environmental integrity, while (2) Hart's rating scheme is designed primarily for indicators of sustainability in its entirety. Therefore, it should be understood that the low score does not imply that Jacksonville's indicators are poor measures of quality of life. In fact, the Life in Jacksonville project has been modeled in many communities.

4.4 Synthesis

The development and selection of effective indicators rest upon a number of factors. On top of it is the involvement of multi-stakeholder in the process. The

Table 6. Rating of Indicators: Summary

Project	Categories	Scores
Santa Monica Sustainable City Program	Resource Conservation	4.3
	Transportation	5.0
	Pollution Prevention and Public Health Protection	4.0
	Community and Economic Development	4.2
	Overall average score	4.4
Sustainable Seattle	Environment	3.4
	Population and Resources	4.3
	Economy	4.1
	Youth and Education	3.4
	Health and Community	3.8
	Overall average score	3.8
Olympia/South Puget Sound Sustainable Community Roundtable	Natural Environment	3.0
	Population	3.0
	Resource Consumption	4.0
	Transportation	3.0
	Housing	5.0
	Economy	4.0
	Social Equity and Justice	3.0
	Health	4.0
	Education	4.0
	Governance	4.0
	Overall average score	3.9
Life in Jacksonville	Education	3.0
	Economy	2.7
	Public Safety	3.0
	Natural Environment	3.3
	Health	3.0
	Social Environment	3.9
	Government/Politics	3.9
	Culture/Recreation	2.8
	Mobility	3.3
	Overall average score	3.2
Boulder Healthy Communities Initiative	Education	3.2
	Environment	3.7
	Health and Wellness	3.2
	Arts and Culture	3.0
	Transportation	4.2
	Business and Economy	2.8
	Children, Youth, Elders, and Families	3.8
	Housing	4.3
	Leadership and Government	3.7
	Neighborhoods	4.5
	Overall average score	4.0
Sustainable San Francisco	Agriculture	5.0
	Air Quality	3.8
	Economy and Economic Development	5.0
	Energy, Climate Change, and Ozone Depletion	4.0
	Environmental Justice	4.0
	Hazardous Materials	4.2
	Human Health	3.3
	Municipal Expenditures	4.5
	Noise	4.3
	Natural Habitat and Biodiversity	4.1
	Parks, Public Spaces, and the Streetscape	3.8
	Public Information and Education	3.6
	Risk Management	2.7
	Solid Waste	4.6
	Transportation	3.4
	Water and Wastewater	3.6
	Overall average score	4.0

community at large determines the community's future – not the government nor the organization that spearheaded the sustainability projects. A democratic process in the identification of indicators makes every individual accountable for the community's progress towards sustainability. Effective indicators reflect the community's vision and should serve the purpose and audience for which they are developed.

4.4.1 Towards Potential Indicators of Sustainability

The results of analyses shown in Tables 5 and 6 were consolidated by selecting the indicator subcategories identified in at least four communities and the corresponding specific measures with a score of at least four points. The result, shown in Table 7, represents the “good” indicators of sustainability. It should be reiterated that these indicators were produced from tying together the results of the two analytical assessments and so, there are biases. First, some high-score, “good” indicators were not included in the list because only one or two communities are using them. Second, an indicator with a low score may not be a “good” indicator based upon the ranking scheme used in the analysis but if it very well serves the community, then its appropriateness as a measure of sustainability cannot be argued. Third, the rating does not factor in the availability and cost of data.

Table 7. "Good" Indicators of Sustainability

Category	Subcategory	Indicator
Economy	Employment	• Employment at top ten companies • Real unemployment • Jobs paying less than the average wage • Number of full time agricultural workers as a % of total employed • % of employed residents in local jobs
Environment	Land use	• Trees in public spaces • Impervious surface area • Land use (zoning) inventory
Government	Participation and civic involvement	• % of registered voters voting • % of population age over 18 voting • People accurately naming two City Council members • People keeping up with local government news frequently • Number of citizen boards city/county-wide
Health	Pregnancy/Birth	• % of women receiving prenatal care during pregnancy
Housing	Cost	• Deed-restricted affordable housing • Housing affordability ratio • Affordability of single-family home • % of median family income spent on housing
Public Safety	Crime incidence and neighborhood watch	• People feeling safe walking alone in neighborhood at night
Resource Use	Energy	• Total energy use • Renewable and nonrenewable energy use • Consumption of electricity from fossil fuels and hydropower • % of renewable energy and recycling-related industries • % of city offices that are energy efficient • Vehicle fossil fuel sales • Vehicle electric and hydrogen fuel used
	Recycling/Reuse	• % of recycled paper purchased by the city • Solid waste recycled • Tonnage diverted from landfill into recycling, reuse, composting • % of home composters • Tons of recycled paper sold in the city
	Solid waste generation	• Landfilled solid waste • Volume of solid waste produced per capita
	Water	• Water usage • Potable city water consumption per household
Society	Culture and arts exposure	• Public participation in the arts • Symphony attendance per 1,000 population
Transportation	Public Transit	• Ridership on city buses • Miles of fixed-route bus service • Number of minutes between buses on scheduled routes during peak & nonpeak periods
	Vehicle use and fuel type	• % of city fleet vehicles using reduced-emission fuels • Vehicle miles traveled and fuel consumption • Vehicle trips per person • Miles traveled by single-occupancy vehicles • Number of alternative fuel vehicles • Number of gasoline powered vehicles • Number of electric vehicles

CHAPTER 5

Conclusions

Building on the Brundtland Commission's definition and agreeing on the holistic concept of sustainability, sustainable urban development involves the integration of environmental, economic, and social concerns in planning and decision making. To attain sustainability, a community's development activities should be able to enhance the natural and built environment in harmony with the need to conserve the limited stock of natural resources and to increase the quality of life and opportunities for present and future generations. Nonetheless, the community's support and commitment are needed to address issues of survival and long-term vitality of the community. These guiding principles support close linkages among environmental issues and broader social and economic issues and consider the long-term implications of actions and decisions.

Indicators help translate the concept of sustainable development into an operational form. A set of sustainability indicators serves as a tool to assess a community's long-term vitality in the context of efficient and integrated economic, environmental, and social systems. Indicators are quantitative and qualitative information that show trends and assist a community in identifying its priorities. By translating a vast amount of information into a simplified form, indicators make complex systems understandable. Indicators not only describe the impacts of human actions on the

overall health of the community but also call for positive actions to reverse any decline. Therefore, the attainment of sustainability rests on every individual.

As the discussions in this research have made clear, social equity, ownership, and participation are at the very core of the notion of sustainability. The development and selection of appropriate indicators of sustainability require strong community support and involvement throughout the process. Citizens need to have a sense of place, a sense of belonging, and a sense of responsibility so that immediate actions could be taken towards the attainment of the sustainability goals for their community.

In identifying sustainability indicators, careful consideration should be made about the community's sustainability goals, the classification and properties of indicators, their intended audience, and their fulfillment of a set of selection criteria. Carefully selected indicators provide planners and decision-makers a sound basis for formulating and implementing appropriate policies and action plans and spur public's attention and support.

Presented below are some important considerations in the development of sustainability indicators:

Community participation

- Sustainability offers a great opportunity for community participation and visioning.
- The involvement of diverse stakeholders is very important in identifying good indicators. This would ensure that the interests of all sectors in the community are taken into account.

- Working together in the development of indicators holds every individual accountable for achieving their preferred future.

Goals of sustainability

- Assessment of progress towards sustainability should be guided by a clear vision and goals that define that vision.
- Environmental integrity, economic health, and social well-being are the integrative goals of sustainability.
- Sustainability ensures the vitality of the community, without undermining the limited capacity of natural environment, now and for the next generation.

Classification and properties of indicators

- Different categories are used in classifying indicators of sustainability. No matter how they are categorized, sustainability indicators should exhibit interconnectedness among the environmental, economic, and social goals of the community.
- There is no rule as to how many indicators are adequate. However, it should be kept in mind that too much or too little information may inhibit the usefulness of indicators
- A community can better measure how far it is from its sustainability goals if indicators are tied with some reference values that characterize a sustainable future.

- Rather than merely showing data, indicators should also reflect linkages among various trends in the urban systems.

Purpose of indicators and intended audience

- Sustainability indicators help a community determine where it has been, where it is, and where it is going.
- Carefully selected indicators provide a whole picture of the community's quality of life and the sustainability of its current path.
- The selection and design of sustainability indicators take account of the audience for which they are intended if they are to be meaningful, reliable, and useful.

Criteria for selection of indicators

- It is deemed impossible to arrive at a set of indicators that meet all the selection criteria (i.e., representativeness, policy relevance, measurability, and others).
- An indicator that a community considers very important should not be excluded on the basis of not meeting an essential criterion.
- The target audience and the purpose for indicator development determine which criteria are important.

Reporting of indicators

- Indicators should be communicated in a simple and understandable manner to gain public's attention and support.
- The indicator report should be regularly updated to keep track of the community's progress.

Data sources and cost

- In selecting sustainability indicators, the availability of data should be given due consideration.
- In the absence of existing information, a practical means of collecting data using current technology can be adopted.
- Data should be collected in a cost-efficient manner, giving importance to reliability and validity of data.

The set of “good” indicators identified in this research are perceived as examples of potential sustainability indicators that can serve as a guidepost for urban communities attempting to develop their own indicators. They are not intended to limit thinking as to what are the best indicators – the community itself determines which indicators would best correspond to their sustainability goals. Nevertheless, as this research has shown, there is an agreement about the basic and relevant indicators of sustainability. It should be pointed out that these indicators were rated on the basis of their meeting a set of criteria for good indicators of sustainability, which circumscribes their appropriateness as

measures of sustainability. However, factors such as availability, ease of access, and cost of data were not fully considered.

5.1 Implications for Planning

Planning for sustainable urban development denotes a broader role in the planning profession. Unlike the traditional planning approach which tackles sectoral issues separately and which puts planners in a confrontational situation between promoting development and protecting environment, planning for sustainable communities is an integrated, holistic process which ensures that the goals of sustainability is built in all policies and plans.

The challenge to planning, therefore, is to be able to balance environmental, social, and economic concerns and assess the consequences of decisions on future generations. The goals of sustainability need to be embedded throughout the planning process – one that takes into account values and ethics and encourages community participation. Building consensus through citizen participation in the planning and decision-making processes would ensure that development is for public interest and that people would take part in pursuing the sustainability goals.

A participatory planning process is essential in the conceptualization of a sustainable community as well as in making this concept operational, which can be achieved through the development and use of sustainability indicators.

Although the development and use of indicators are still in the early stage, indicators can be an important tool in planning and decision making. Effective indicators

of sustainability can guide a community's path to a sustainable future. Through indicators, planners would be able to promote appropriate development that gives consideration to the environmental capacity, thus paving the way to sustainable forms of urban development.

As has always been said in this thesis, "effective planning" is crucial in translating the vision of sustainability into reality. Indicators can be useful in many planning activities such as problem identification, allocation of resources, development of policies, establishment of an action plan, and policy assessment.

5.2 Future Research

"Good" indicators take into account the community's long-term sustainability in the context of global sustainability. As such, indicators of sustainability should emphasize interdependence not only among the environmental, economic, and social systems but also between geographic boundaries.

Future research is recommended on the development of a core set of indicators capable of comparing progress towards sustainability. The set of "good" indicators presented in this research can serve as a starting point. Additional indicators should encompass as many fundamental selection criteria as possible while meeting the sustainability goals. Some may argue about the use of a core set of indicators. However, it should be pointed out that changes and conditions in one community should be comparable with the changes occurring in the neighboring communities because sustainability concerns not only a limited space – sustainability is a global concern. This

core set of indicators can assist policy makers improve their efforts to manage for greater sustainability.

In addition, an extensive analysis of sustainability indicators can be made to determine the extent of impact of urban patterns on the environment, given its limited carrying capacity. This analysis could trigger immediate actions to counteract negative changes in the state of the community.

It is also worth looking at the extent to which sustainability indicators are used as a tool for decision making. For instance, one of the recommendations in the Santa Monica Sustainable Progress Report is to develop an implementation plan for the Sustainable City Program, which would include specific action plans for meeting the indicator targets and for integrating the program into City operations. Evaluating the effects of indicators on the decision-making process could be a subject of future research.

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APPENDIX

- A. Rating of Specific Indicators
- B. List of Contact Persons and Organizations

APPENDIX A

Rating of Specific Indicators

Santa Monica Sustainable City Program

Categories	Indicators	Scores
Resource Conservation	Landfilled solid waste (tons/year)	4
	Water usage (million gallons per day)	4
	Energy usage (million MBTUs per year)	4
	Average postconsumer recycled/tree-free content of city office paper purchases	5
		4.3
Transportation	Annual ridership on Santa Monica Municipal Bus Line	5
	Average vehicle ridership of Santa Monica Employers with over 50 employees	5
	% of city fleet vehicles using reduced-emission fuels	5
		5.0
Pollution Prevention and Public Health Protection	Hazardous waste generated by city operations	5
	City purchases of hazardous materials	5
	Compliance with Federal UST standards for all underground storage tanks	2
	Known underground storage tank sites requiring cleanup	2
	Diversion or treatment of dry weather stormwater runoff	5
	Wastewater flows (million gallons per day)	5
		4.0
Community and Economic Development	Create and implement Sustainable Schools Program	6
	Deed-restricted affordable housing units	4
	Public open space (acres)	3
	Number of community gardens	4
	Trees in public spaces	4
		4.2

Overall average score: 4.4

APPENDIX A (continued)

Sustainable Seattle

Categories	Indicators	Scores
Environment	Wild salmon returning to spawn	4
	Wetlands quality	3
	Plant and amphibian diversity	4
	Turbidity in streams and rivers	3
	Air quality index	2
	% of streets that are pedestrian friendly	4
	% of villages with sufficient open space	3
	Impervious surface area (acre)	4
		3.4
Population and Resources	Population in King County	3
	Water consumption (million gallons/year)	4
	Solid waste generated and recycled	5
	Volumes of toxic releases and recycled paper usage	5
	Farm acreage	4
	Vehicle miles traveled and fuel consumption	4
	Renewable and nonrenewable energy use	5
		4.3
Economy	Employment at top ten companies	5
	Real unemployment	4
	Distribution of personal income	4
	Health care expenditures	2
	Work hours required each month for basic needs	6
	Housing affordability ratio	5
	Children living in poverty	3
	Appropriate emergency room use	4
	Total annual deposits and per capita deposits	4
		4.1
Youth and Education	Adult literacy	4
	High school graduation	3
	Ethnic diversity of teachers	4
	Arts instruction	2
	Volunteer involvement in schools	4
	Juvenile crime rate	3
	Youth involvement in community service	4
		3.4
Health and Community	Youth criminal activities as a ratio to ethnic percentage in population	4
	Low birthweight infants	3
	Asthma hospitalization rate for children	4
	% of registered voters voting; % of population over 18 years old voting	4
	Attendance at Seattle community centers	4
	Public library circulation rates	3
	Public participation in the arts	4
	Gardening activities	4
	Neighborhood activities	4
	Number of people who feel good about the quality of their lives	5
		3.8

Overall average score: 3.8

APPENDIX A (continued)

Olympia/South Puget Sound Sustainable Community Roundtable

Categories	Indicators	Scores
Natural Environment	Acres of protected open space	3
Population	Total population in Thurston County	3
Resource Consumption	Water usage in urban areas (gallons per day)	4
	Olympia farmers' market sales	5
	Total waste landfilled (tons/year)	4
	Consumption of electricity from fossil fuels and hydropower	5
		4.0
Transportation	Motor vehicle ownership and CO2 emissions	3
Housing	Average apartment rent compared to average wage	5
Economy	Jobs paying less than the average wage	4
Social Equity and Justice	Violent crime rate; juvenile arrests for violent crime	3
Education	Quality of learning achieved through educational institutions	4
Health	Deaths from heart disease and cancer per 100,000 population	4
Governance	% of eligible voters voting	4

Overall average score: 3.9

APPENDIX A (continued)

Life in Jacksonville

Categories	Indicators	Scores
Education	Public high-school graduation rate	3
	Average achievement-test percentile scores	3
	Public school expenditures per student	2
	Average public school teacher salary	2
	Teachers holding advanced degrees	3
	Students attending desegregated schools	5
	Faculty holding terminal degrees	3
	Higher-education degrees awarded	3
	Student participation in higher education programs	3
		3.0
Economy	Net job growth	1
	Total/black unemployment gap	4
	Effective buying income per capita	6
	Retail sales per capita	2
	Taxable real estate value	2
	New housing starts	1
	Affordability of single-family home	4
	Students in free/reduced lunch program	3
	Tourism/bed-tax revenues	2
	Cost of 1,000 kwh of electricity	2
		2.7
Public Safety	People feeling safe walking alone at night	4
	Index crimes per 100,000 population	3
	People reporting being victims of crime	3
	Average rescue call response time (min.)	3
	Average fire call response time (min.)	3
	Average priority-one call response time (min.)	3
	Accidental deaths per 100,000 population	2
	Motor vehicle accidents per 1,000 population	3
		3.0

APPENDIX A (continued)

Life in Jacksonville

Categories	Indicators	Scores
Natural Environment	Days with air quality index in good range	3
	River compliance with metals water standards	3
	Compliance with dissolved oxygen standards	3
	Water level in Floridan-aquifer wells (ft.)	4
	Potable city water consumption per household	4
	New septic-tank permits issued	2
	Sign permits issued	3
	Tons per capita of solid waste	4
		3.3
Health	Infant deaths per 1,000 live births	3
	Age-adjusted deaths per 100,000 population	1
	Deaths from heart disease per 100,000 population	4
	Deaths from lung cancer per 100,000 population	4
	Packs of cigarettes sold per capita	2
	New AIDS cases per 100,000 population	3
	Alcohol use reported by youth	3
	People rating health-care system good/excellent	4
	People reporting having no health insurance	3
		3.0
Social Environment	People believing racism is a local problem	4
	Substance-exposed newborns per 1,000 live births	3
	Substantiated child abuse/neglect reports per 1,000 children under 18	4
	Births to females under 18 per 1,000 live births	4
	Employment discrimination complaints filed w4ith JEOC	4
	People reporting they volunteered last year	4
	Contributions per capita to United Way and agencies	4
		3.9

APPENDIX A (continued)

Life in Jacksonville

Categories	Indicators	Scores
Government/Politics	People who rate local government leadership good/excellent	4
	% 18 and older registered to vote	3
	% registered who vote	4
	% of local elected officials nonwhite/female	4
	People accurately naming two City Council members	4
	People keeping up with local government news frequently	4
	People feeling local public services frequently effective	4
		3.9
Culture/Recreation	City financial support per capita of arts organizations	2
	City parks/recreation expenditures per capita	2
	Public park acreage per 1,000 population	3
	Public library materials per capita	3
	Public library book circulation per capita	3
	Event/days of bookings at major city facilities	2
	Symphony attendance per 1,000 population	4
	Zoo attendance per 1,000 population	3
		2.8
Mobility	People reporting commuting time 25 minutes or less	5
	Weekday commercial flights in and out of JIA	1
	Destinations with direct flights in or out of JIA	1
	Average weekday JTA bus ridership per 1,000 population	5
	Average weekday miles of JTA bus service	4
	JTA bus headways within 30 minute peak/60 minute nonpeak	4
		3.3

Overall average score: 3.2

APPENDIX A (continued)

Boulder Healthy Communities Initiative

Categories	Indicators	Scores
Education	Composite test scores	3
	Dropout rates	3
	Graduation rates	3
	Student/teacher ratio	3
	Number of adults enrolled in life long learning	4
		3.2
Environment	Land use (zoning) inventory	4
	Water quality index	2
	Air quality index	2
	Solid waste produced per capita	4
	Solid waste recycled	5
	Renewable and nonrenewable energy use	5
		3.7
Health and Wellness	Population demographics	3
	Birth and death rate; % low birthweight births	3
	Cost of living index	4
	% of households with health care insurance	3
	Tax revenues of alcohol and tobacco sales	3
		3.2
Arts and culture	Total circulation of library materials	3
	Total space (sq. ft) for galleries, museums, theaters, and other arts venues	3
		3.0
Transportation	RTD annual patronage	5
	Miles of bike trails and lanes	4
	Number of miles traveled by single-occupancy vehicles	4
	% of employees using alternate modes to get into work	5
		4.2
Business and Economy	Number of full time agricultural workers as a % of total employed	4
	Leading economic indicator series	1
	Average commute time for county residents	5
	Suitable job for Boulder County residents	1
		2.8

APPENDIX A (continued)

Boulder Healthy Communities Initiative

Categories	Indicators	Scores
Children, Youth, Elders, and Families	Teen birth rates	4
	Number of people meeting food-stamp criteria	3
	Average cost of childcare	4
	Unemployment rate for disabled	4
	Volunteers to programs for children, youth, elderly, disabled, homeless	4
		3.8
Housing	% of median family income spent on housing	4
	Length of waiting list for subsidized housing	3
	% employees who work in communities in which they live	6
		4.3
Leadership and Government	Number of agreements between governments	3
	% of eligible voters who vote in general election	4
	Number of citizen boards county-wide	4
		3.7
Neighborhoods	Crime statistics	3
	% of dwelling units within 0.5 miles of open space	6
	Safety walking alone in neighborhood at night	4
	Individuals who know their neighbors' names	5
		4.5

Overall average score: 4.0

APPENDIX A (continued)

Sustainable San Francisco

Categories	Indicators	Scores
Agriculture	Number and size of farmer's markets within city limits	5
	% of locally sold food raised within 100 miles of city limits	5
	% of food grown within city limits	5
		5.0
Air Quality	Levels of ozone, CO2, and other gases and particles	2
	Muni ridership	5
	Number of bicycle commuters	4
	Vehicle miles traveled per person	4
	Vehicle trips per person	4
		3.8
Economy and Economic Development	% of energy consumed from renewable resources	5
	% of renewable energy and recycling-related industries	5
	% of employed residents in local jobs	5
		5.0
Energy, Climate change, and Ozone Depletion	Energy use	4
	Vehicle fossil fuels sales	4
	Vehicle electric and hydrogen fuel used	5
	Number of alternative fuel vehicles	5
	Number of registered vehicles	3
	Amount of CFCs recovered	3
	Number of tree planting permits	4
	Number of school including energy use in curriculum	4
		4.0
Environmental Justice	Incidence of disease "clusters" disproportionately located in low-income neighborhoods	4
	Number of transit lines and frequency of service in low-income neighborhoods compared to the city at large	4
	Incidence of robbery and homicide per unit of population in low-income neighborhoods	4
		4.0
Hazardous Materials	Weight of hazardous materials discarded per household & business	4
	Number of households and businesses utilizing the hazardous waste facility	5
	Amount of toxic and hazardous materials purchased by the city government	5
	Toxic and hazardous materials purchased by the citizens	5
	Pollutant levels from wastewater discharge	3
	Number of deaths from accidental chemical poisoning	3
		4.2

APPENDIX A (continued)

Sustainable San Francisco

Categories	Indicators	Scores
Human Health	Number of deaths from cancer	4
	Smoking population	2
	Number of deaths from homicide	3
	% of women receiving prenatal care during pregnancy	4
	% of population riding a bicycle to work or for recreation	4
	% of the population infected with HIV virus	3
		3.3
Municipal Expenditures	% of recycled printing and writing paper purchased by city	5
	Weight of pesticides purchased by the city and county	4
	Proportion of budget allocated to paper and office supplies	5
	% of city offices that are energy efficient	4
		4.5
Noise	Annual number of citizens complaints	3
	Number of gasoline powered vehicles	5
	Number of electric vehicles	5
		4.3
Natural Habitat and Biodiversity	Acres of open space in natural settings	3
	Water quality in inland lakes	4
	Number of bird species within city limits	4
	Length of creeks in natural settings	4
	Salmon run populations	4
	Native species populations	5
	Nonnative species populations	5
	Number of fish species in the bay	4
	Populations within fish species	4
	Acres of restored habitat in San Francisco	5
	Miles of public trails	3
		4.1
Parks, Public Spaces, and the Streetscape	Acres of open space per person	3
	Facility repair backlog	4
	Number of trees per mile of city streets	4
	Number of trees planted or replanted in parks	4
		3.8

APPENDIX A (continued)

Sustainable San Francisco

Categories	Indicators	Scores
Public Information and Education	High school graduation rate	3
	% of elementary students in environmental curriculum	4
	% of high school students completing four years of math	4
	% of people learning English among newcomer populations	4
	Hours/day of television viewing among school age people	4
	% of San Francisco schools that offer art, music, and physical education classes	2
	Number of hours city libraries are open	4
		3.6
Risk Management	Number of fires	2
	Incidence of improper handling and storage of hazardous waste	2
	Number of citizens participating in neighborhood emergency response teams	4
		2.7
Solid Waste	Weight of discards per person	4
	Tonnage diverted from landfill into recycling, reuse, composting	4
	% of home composters	5
	Tons of recycled paper sold in the city	5
	Paper product purchases by the City	5
	Use of recycled paper and recycled products by city govt.	5
	Landfilled solid waste	4
		4.6
Transportation	Ridership on muni and regional transit to San Francisco	5
	Automobile registration in San Francisco	3
	Gasoline sales	4
	Number of gridlocked streets during commute rush hours	3
	Air quality	2
		3.4
Water and wastewater	Water usage per capita	4
	% of wastewater reused	5
	% of public landscaping in drought resistant plantings	4
	Volumes of stored water	4
	% of public schools with water management issues in curriculum	4
	Volume of water discharges into the San Francisco Bay & ocean	2
	Number of times out of compliance with State potable water quality standards	3
	Number of times out of compliance with State discharged water quality standards	3
		3.6

Overall average score: 4.0

APPENDIX B

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VITA

Leonida Corcuera was born in Marikina, Philippines on July 31, 1962. She entered Adamson University in 1978 where she received the degree Bachelor of Science in Chemistry in 1982.

Ms. Corcuera joined the Department of Science and Technology (DOST) in 1983. She has held a supervisory position at the Philippine Council for Advanced Science and Technology Research and Development (PCASTRD), a DOST-sectoral council, since 1994. During her employment with PCASTRD, Ms. Corcuera had been involved with various undertakings such as the World Bank-funded human resources development project, the Philippine-Australia Remote Sensing project, the National Coordinating Committee for Remote Sensing, among others.

Ms. Corcuera gained some academic background in economics during her pursuit of a master's degree at Ateneo de Manila University from 1991 to 1993. Family demands and professional commitment prevented her from finishing the graduate program. In 1993, Ms. Corcuera was awarded the Netherlands Fellowship Program for a Diploma in Development Planning Techniques at the Institute of Social Studies, The Hague, Netherlands.

Not giving up her desire of completing a master's degree, Ms. Corcuera entered Graduate School at the University of Tennessee, Knoxville in 1995.