Indicators of Sustainable Development

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1.0 Introduction

The word for *indicator* in Arabic is *pointer*. Indicators point to a desirable outcome, to 'which way is up' in the policy arena.

The different levels of data for policy purposes are shown in the Information Pyramid. At the bottom of the pyramid are *data*, which unprocessed are of little value for policy purposes. Once data are processed into *statistics* or tables, they can be used in reports or as the basis for ad-hoc evaluations, but still they are often difficult to understand or use for policy. *Indicators* are statistics directed specifically towards policy concerns and which point towards successful outcomes and conclusions for policy. They are usually highly aggregated and have easily recognizable purposes. Classic indicators include the unemployment rate or GDP growth, numbers which are such powerful and recognizable indicators of performance that they may cause governments to fall. At the highest level are *indices*, such as the consumer price index or human development index, which combine different indicators into a single number useful for comparison over time and space.

Measuring and monitoring environmental conditions has been a major concern of Governments and international organisations during the 1990's. Some of the main international initiatives have included the activities of UNSTAT/UNEP, including the the State of the World Environment and Environmental Data Report series (1994), the development of an Earthwatch database and the beginnings of the development of a series of environmental indicators. Other bodies such as OECD and WHO have been involved in the development of a conceptual framework.

2.0 Recently Developed Indicators

Growing realization of the failings of the conventional GNP and income as the primary indicators of economic progress has led to the development of alternative yardsticks. Two interesting recent efforts are the Human Development Index (HDI) devised by the United Nations Development Programme and the Index of Sustainable Economic Welfare (ISEW) developed by economist Herman Daly and theologian John Cobb. A third indicator, per capita grain consumption, is a useful measure of changes in well-being in low-income countries, where the data needed to calculate the more sophisticated indices are typically not available on an annual basis.

The Human Development Index, measured on a scale of 0 to 1, is an aggregate of three indicators: longevity, knowledge, and the command over resources needed for a decent life. For longevity, the UN team uses life expectancy at birth. For knowledge, they use adult literacy and mean years of schooling. And for the command over resources, they use gross domestic product (GDP) per person after adjusting it for purchasing power. Because these indicators are national averages, they do not deal directly with inequalities in wealth distribution, but by including longevity and literacy they do reflect indirectly the distribution of resources. A high average life expectancy, for example, indicates broad access to health care and adequate supplies of food and safe drinking water.

A comparison of countries ranked by both per capita gross domestic product (adjusted for purchasing power) and HDI reveals some wide disparities. Costa Rica ranks 40th in the HDI, while South Africa, with an adjusted per capita GDP 27 percent higher than Costa Rica's, comes in at number 57. Despite their lower average purchasing power, Costa Ricans boast an adult literacy rate of 92 percent, compared with only 85 percent in South Africa, and at birth can expect to live 13 years longer than a newly born South African. Argentina, Chile, Poland, and Yugoslavia are among the other countries exhibiting high human development with

comparatively modest per capita income.

The HDI is still evolving; indeed, the country rankings published in 1991 differ markedly in some cases from those in 1990, the first year of the index, because of refinements made by the UN team. As more data become available, the HDI will begin to capture other determinants of human development as well. For example, enough information already exists in 30 countries to include sex inequalities in the HDI. When this is done, top-ranked Japan drops to number 17, while Finland, where women have rights and economic opportunities comparable to men's, moves up from 13 to number 1. Similarly, an HDI sensitive to the distribution of income has been calculated for 53 countries that could provide the needed data; again, the rankings change when this important factor is included.

While the HDI represents a distinct improvement over income figures as a measure of human well-being, it so far says nothing about environmental degradation. As a result, the HDI can rise through gains in literacy, life expectancy, or purchasing power that are financed by the depletion of natural resources, setting the stage for a longer term deterioration in living conditions.

The Daly-Cobb Index of Sustainable Economic Welfare, on the other hand, is a more comprehensive indicator of well-being, taking into account not only average consumption but also distribution and environmental degradation. To date, it has only been calculated for the United States. After adjusting the consumption component of the index for distributional inequality, the authors factor in several environmental measures, such as depletion of nonrenewable resources, loss of farmland from soil erosion and urbanisation, loss of wetlands, and the cost of air and water pollution. They also incorporate what they call "long-term environmental damage", a figure that attempts to take into account such large-scale changes as the effects of global warming and of damage to the ozone layer.

Applying this comprehensive measure shows a rise in welfare per person in the United States of some 42 percent between 1950 and 1976. But after that the ISEW began to decline, falling by just over 12 percent by 1988, the last year for which it was calculated. Simply put, about 15 years ago the net benefits associated with economic growth in the United States fell below the growth of population, leading to a decline in individual welfare.

The principal weakness of the ISEW is its dependence on information that is available in only a handful of nations. For example, few developing countries have comprehensive data on the extent of air and water pollution, not to mention measurements of year-to-year changes. The same drawback applies to the HDI, since life expectancy data depend heavily on infant mortality information that, astonishing as it may seem, is collected at best once a decade in most of the Third World.

Per capita grain consumption, however, is a useful measure of well-being in low-income countries that can be tracked on a yearly basis. This indicator captures the satisfaction of a basic human need, since people cannot survive if annual grain consumption falls much below 180 kilograms (about 1 pound a day) for an extended period. It is also less vulnerable to distortion by inequities of income and wealth. While the distribution of wealth between the richest and poorest one fifth of a population can be as great as 20 to 1, as indeed it is in Algeria, Brazil, and Mexico, per capita consumption of grain by these same groups will not vary by more than 4 to 1.

One drawback with this indicator is that it says nothing about how much of the grain consumed was produced unsustainably - by eroding soils, depleting water supplies, and the like. Another is that at some point, higher per capita grain consumption starts to imply a deterioration in human well-being rather than an improvement. Toward the top end of the scale people are consuming fat-rich livestock products known to increase heart disease and colon, breast, and other types of cancer, leading to an overall reduction in life expectancy. Per capita grain consumption is therefore best used as an indicator of well-being only in poorer countries.

3.0 Computing the Human Development Index

The HDI is based on three indicators: longevity, as measured by life expectancy at birth; educational attainment, as measured by a combination of adult literacy (two-thirds weight) and combined primary, secondary and tertiary enrolment ratios (one-third weight): and standard of living as measured by real GDP per capita (PPP$).
For the construction of the index, fixed minimum and maximum values have been established for each of these indicators:

Life expectancy at birth:
      20 years and 85 years
Adult literacy:
      0% and 100%
Combined enrolment ratio:
      0% and 100%
Real GDP per capita (PPP$):
      PPP$100 and PPP$10,000

For any component of the HDI, individual indices can be computed according to the general formula:

$$\text{Index} = \frac{\text{Actual } x_1 \text{ value - minimum } x_1 \text{ value}}{\text{Maximum } x_1 \text{ value - maximum } x_1 \text{ value}}$$

If for example, the life expectancy at birth in a country is 65 years, the index of life expectancy for this country would be:

$$\text{Life expectancy index} = \frac{65 - 25}{85 - 25} = \frac{40}{60} = 0.667$$

The construction of the income index is a little more complex. The average world income of PPP\$5.711 is taken as the threshold level (y^*), and any income above this level is discounted using the following formulation based on Atkinson's formula for the utility of income:

$$W(y) = y^* \text{ for } 0 < y < y^*$$
$$= y^* + 2[(y \cdot y^*)^{1/2}] \text{ for } y^* \le y \le 2y^*$$
$$= y^* + 2\,(y^{*1/2}) + 3\,[(y \cdot 2y^*)^{1/3}] \text{ for } 2y^* \le y \le 3y^*$$

To calculate the discounted value of the maximum income of PPP\$40.000, the following form of Atkinson's formula is used:

$$W(y) = y^* + 2(y^{*1/3}) + 3(y^{*1/3}) + 4(y^{*1/4}) + 5(y^{*1/3})$$
$$+ 6(y^{*1/6}) + 7(t^{*1/7}) + 8[(40,000 \cdot 7y^*)^{1/8}]$$

This is because PPP\$40,000 is between $7y^*$ and $8y^*$. With the above formulation, the discounted value of the maximum income of PPP\$540,000 is PPP\$6,040.

The construction of the HDI is illustrated with two examples - Greece, an industrial country and Gabon, a developing country:

Country	Life expectancy (years)	Adult literacy (%)	Combined enrolment ratio (%)	Real GDP per capita (PPP$)
Greece	77.7	93.8	78	8,950
Gabon	53.7	60.3	47	3,861

Life expectancy index:

$$\text{Greece} = \frac{77.7 - 25}{85 - 25} = \frac{52.7}{60} = 0.878$$

$$\text{Gabon} = \frac{53.7 - 25}{85 - 25} = \frac{28.7}{60} = 0.478$$

Adult literacy index:

$$\text{Greece} = \frac{93.8 - 0}{100 - 0} = \frac{93.8}{100} = 0.938$$

$$\text{Gabon} = \frac{60.3}{100 - 0} = \frac{60.3}{100} = 0.603$$

Combined primary, secondary and tertiary enrolment ratio index

$$\text{Greece} = \frac{18 - 0}{100 - 0} = 0.780$$

$$\text{Gabon} = \frac{47 - 0}{100 - 0} = 0.470$$

Educational attainment index

Greece = [2(0.938) + 1(0.780)] ¸ 3 = 0.885

Gabon = [2(0.603) + 1(0.470)] ¸ 3 = 0.558

Adjusted real GDP per capital (PPP$) index Greece's real GDP per capital at PPP$8,950, is above but less than twice the threshold. thus, the adjusted real GDP per capita for Greece would be PPP$5,825 because 5,825 = [5,711 + 2(8.950 - 5,711)1/2]

Gabon's real GDP per capita, at PPP$3,861, is less than the threshold, so it needs no adjustment.

The adjusted real GDP per capita (PPP$) index for Greece and Gabon would be:

5,825 - 100 5,725
Greece = 6,040 - 100 = 5,940 = 0.964

3,861 - 100 3,761
Gabon = 6,040 - 100 = 5,940 = 0.633

Human development index

The HDI is a simple average of the life expectancy index, educational attainment index and the adjusted real GDP per capita (PPP$) index. It is calculated by dividing the sum of these three indices by 3. The HDI values for Greece and Gabon are calculated using this formula:

Country	Life expectancy index	Educational attainment index	Adjusted real GDP per capita (PPP$) index	S	HDI
Greece	0.878	0.885	0.964	2.727	0.909
Gabon	0.478	0.558	0.633	1.669	0.557

4.0 Monitoring Progress on Sustainable Development: Sustainable Development Indicators

Refer to http://www.undp.org/undp/devwatch/indicatr.htm

The document below is an EXTRACT from a Report of the Department for Policy Coordination and Sustainable Development (DPCSD), United Nations Division for Sustainable Development.

4.1 Introduction

Chapter 40 of Agenda 21 calls for the development of indicators for sustainable development. In particular, it requests countries at the national level, and international governmental and non-governmental organisations at the international level to develop the concept of indicators of sustainable development in order to identify such indicators.
This issue was raised during the first two sessions of the Commission on Sustainable Development (CSD), at which time a large number of countries emphasized the urgent need for these indicators. Other countries expressed some concern and insisted that indicators be developed in close contact with Governments. Pursuant to the multi-year programme of work adopted by the Commission at its first session, the progress achieved on developing these indicators, in the context of Chapter 40 of Agenda 21, will be discussed by the Commission during its third session.
The objective of this work programme is primarily to make the indicators for sustainable development accessible to decision-makers at the national level by defining them elucidating their methodologies and providing training and other capacity-building activities, as relevant. Indicators, as used in national policies, may also be used in the national reports to the CSD and other intergovernmental bodies.

4.2 Indicators for Sustainable Development

An increasing number of organisations has responded to the challenge of Agenda 21 to develop indicators for sustainable development in the short-term. Some of this work is being undertaken around specific issues, such as health and the environment, or human settlements; others are attempting to define a full set of indicators. Such redundancy and overlap has been extremely

valuable, since it has generated more creative thinking and a shared sense of purpose. The role of the Department for Policy Coordination and Sustainable development, as Task Manager of this issue, is now to coordinate the fruits of this work, to underline areas of convergence, and to bring together the many actors in a broad, cooperative programme that may directly serve the needs of the Commission on Sustainable Development, as well as all Member States. Much further work, primarily by the scientific community, is needed in order to understand and explicate these interlinkages.

Economic indicators have ben used for many years at national, regional and international levels. Social indicators have also been developed over the past years and are widely used all over the world. It is feasible to select among the economic and social indicators those which capture the specific issues most relevant to sustainable development. Institutional indicators related to Agenda 21 or sustainable development are largely undeveloped and are at this stage limited to so-called yes/no indicators. Environmental indicators have been developed more recently. For some of the environmental aspects, data will not be easily available. Recent initiatives include the environment statistics programme of the United Nations Statistical Commission, environmental indicators being developed by UNEP, the UN system-wide *Earthwatch*, the OECD, various relevant international legal instruments, and so forth.

Based on relevant indicators that are available, it is proposed that the *Commission on Sustainable Development* agree that work will proceed on the basis of a core set of indicators, as contained in Table 1 (see *Indicator Template on main menu*), with the understanding that this is a flexible, working set of indicators that will be fine-tuned to the needs of countries after further methodological work, testing and training. It is further proposed that the Commission approve the work programme on indicators for sustainable development, including the following elements: (1) preparation of methodology sheets for distribution to governments; (2) testing of the indicators, on a voluntary basis, in three to four countries and their subsequent adaptation, as needed; (3) organisation of national and regional training workshops and other capacity-building activities, upon request; and (4) evaluation and readjustment of the indicators on the basis of experience and further research as national and international levels, including in the context of international legal instruments.

It is also proposed that the Commission of Sustainable Development encourage continued cooperation with the work underway on environment indicators under the auspices of the United Nations Statistical Commission.

4.3 Highly Aggregated Indicators

Concurrently, work may proceed with developing highly aggregated indicators for sustainable development. Although this represents a longer-term effort, it is important for three reasons: it explores the relationship among the variable, which lies at the heart of the linkages intrinsic to sustainable development; it concentrates information collection and analysis and facilitates presentation to decision-makers; and, it may serve as the basis of an early warning systems, if desired.

A project is now being undertaken by the Scientific Committee on Problems of the Environment (SCOPE), in cooperation with UNEP, aiming at developing highly aggregated indicators for sustainable development. This initiative is currently focusing on the environmental aspects of sustainability although the project could be broadened to focus on other aspects of sustainable development, as well.

4.4 A Core Set of Indicators for Sustainable Development:

A core set of indicators, as contained in Table 1 (*see Indicator Template on main menu)* is proposed for monitoring progress at a national level towards sustainable development through the implementation of Agenda 21. It is fully recognised that there is need for flexibility as the conditions, activities and priorities for sustainable development differ from country to country. At same time, the need for international comparability calls for the development of standardised concepts, definitions and classifications of indicators.

As mentioned, regional workshops and capacity-building programmes are needed in order to facilitate the use of the core set of indicators at a national level. Testing of the indicators in three to four countries could be used to gain experience and further develop the indicators, and evaluation of the use of the indicators at the national level, and national and international developments, could be used to adjust the core set of indicators if necessary.

The indicators in the core set are presented in a Driving Force - State - Response (DSR) framework. The DSR framework is adopted from the widely agreed framework for environmental indicators, the Pressure - State - Response framework. The concept of "pressure" has been replaced by that of "Driving Forces", in order to accommodate more accurately the addition of economic, social and institutional indicators. "Driving force" indicators indicate human activities, processes and patterns that impact on sustainable development, "state" indicators indicate the "state" of sustainable development and "response" indicators indicate policy options and other responses to the changes in the "state" of sustainable development.

In the core set, the indicators are grouped in categories covering the economic, social, institutional and environmental aspects of sustainable development. The indicators are related to chapters of Agenda 21. The coverage of the four aspects of sustainable development and of all the chapters of Agenda 21 ensures that the most significant aspects of sustainable development are monitored by the indicators.

The indicators in the proposed framework have been developed in accordance with the following criteria:

(a) primarily national in scale or scope (countries may also wish to use indicators at state and provincial levels);

(b) relevant to the main objective of assessing progress towards sustainable development;

(c) understandable in that they are clear, simple, and unambiguous;

(d) realizable within the capacities of national governments, given their logistic, time, technical and other constraints;

(e) conceptually well founded;

(f) limited in number, remaining open-ended and adaptable to future developments;

(g) broad in coverage of Agenda 21 and all aspects of sustainable development;

(h) representative of an international consensus, to the extent possible; and

(i) dependent on data which are readily available or available at reasonable cost/benefit ratio, adequately documented, of known quality and updated at regular intervals.

As noted, the core set of indicators may change and new indicators may be included, for example, in the context of international legal agreements, or as national level experience is gained. Furthermore, there are some potentially important indicators which require further methodological work before they can be used. This is especially the case for various ecosystem (geo-referenced) indicators, including biodiversity and other habitat indicators, and for the following issues, for which indicators are not included in the core set at this stage:

- transfer of technology (driving force, state and response indicators);
- science (driving force, state and response indicators);
- capacity-building (driving force, state and response indicators);
- decision-making structures (driving force indicators);
- strengthening of "traditional information" (driving force and response indicators);
- role of major groups (driving force and response indicators);
- oceans, all kinds of seas and coastal areas (response indicators);
- desertification and drought (response indicators);
- sustainable mountain development (driving force, state and response indicators);
- biotechnology (driving force, state and response indicators); and,
- toxic chemicals and hazardous wastes (response indicators).

Research and experimentation with advanced economic, social and institutional indicators that might more effectively measure progress toward sustainable development and continued research and experimentation with environmental indicators appropriate for measuring progress toward sustainable development should be endorsed. There may also be need for subsets and other, often more comprehensive, sets of indicators for other purposes.

Table 1: Core Set of Indicators for Sustainable Development

Category	Chapters of Agenda 21	Driving Force Indicators	State Indicators	Response Indicators
Economics	Chapter 2: International cooperation	o Real GDP per capita o growth rate (%) o Exports of goods and services (US$) o Imports of goods and services (US$)	o GDP per capita (US$) o EDP per capita/ environmentally adjusted value added (US$) o Share of manufacturing valued added in GDP (%) o Export concentration ratio (%)	o Investment share in GDP (%)

	Chapter 4: Consumption and production patterns (1)	o Depletion of mineral resources (% of proven reserves) o Annual energy consumption per capita (J)	o Proven mineral reserves (t) o Proven energy reserves (oil equivalents) o Lifetime of proven energy reserves (years)	o Ratio of consumption of renewable sources over non-renewable resources (%)
	Chapter 33: Financial resources and mechanisms		o Total ODA given or received as percentage of GDP (%)	o Environment protection expenditure as % of GDP o Environment taxes and subsidies as % of government revenue o Amount of new or additional funding for sustainable development given/received since 1992 (US$) o Programme of integrated environment and economic accounting (yes/no)
	Chapter 34: Transfer of technology			
Social	Chapter 3: Poverty	o Unemployment rate (%)	o Population living in absolute poverty (no and %)	
	Chapter 5: Demographic dynamics and sustainability	o Total fertility rate o Population growth rate (%) o Population density (persons/km²) o Net migration rate (persons/year)		
	Chapter 36: Promoting education, public awareness and training (including gender issues)		o Adult literacy rate (%) o Primary school enrolment ratio (%) o Secondary school enrolment ratio (%) o Population reaching grade 5 of primary education (%) o Expected years of schooling	o % of GDP spent on education o Females per 100 males in secondary school (no) o percentage of women in civil service (%) o Women per 100 men in the labour force (%)
	Chapter 6 (2): Protecting and promoting human health	o % of people without access to safe drinking water o Pesticide residue in fish (mg/kg) o % of urban population exposed to concentrations of SO_2, particulates, ozone, CO and Pb o Calorie supply per capita (calories/day) o Concentration of coliforms and pesticides in drinking water (mg/1)	o Infant mortality rate (per 1,000 births) o Life expectancy at birth (years) o Incidence of environmentally related diseases (no)	% GDP spent on health
	CG Chapter 7 (3): Human settlements (including traffic and transport)	o Rate of growth of urban population (%) o Motor vehicles in use (no) o Number of megacities (10 mill. or more)	o % of population in urban areas o Area and population of marginal settlements (km², no) o Cost/number of injuries and fatalities related to natural diasters 4 o Floor area per person (m²) o % of population with sanitary services	o Expenditure on low-cost housing (US$) o Expenditure on public transportation (US$) o Infrastructure expenditures per capita (US$)
Institutional	Chapter 35: Science			
	Chapter 37: Capacity-			

	building			
	Chapter 8, 38, 39, 40: Decision-making structures		o Mandated EIA (yes/no) o Programmes for national environmental statistics and indicators for sustainable development (yes/no) o Sustainable development strategies (yes/no) o National councils for sustainable development (yes/no) o Main telephone lines per 100 inhabitants (no)	o Ratification of international agreements related to sustainable development (no)
	Strengthening of "traditional information" (part of ch. 40)		o Representatives of indigenous people in national councils for sustainable development (yes/no) o Existence of database for traditional knowledge information (yes/no)	
	Chapter 23-32: Role of major groups		o Representatives of major groups in national councils for sustainable development (yes/no)	
Environmental				
Water	Chapter 18: Freshwater resources	o Annual withdrawals of ground and surface water as % of available water o Industrial/ municipal discharges into freshwater bodies (t/m^3) o Household consumption of water per capita (m^3)	o Groundwater reserves (m^3) o Concentration of lead, cadmium, mercury and pesticides in freshwater bodies (mg/l) o Concentration of faecal coliform in freshwater bodies (no/100 ml) o Acidification of freshwater bodies (pH value) o BOD and COD in water bodies (mg/l)	o Waste water treatment (% of population served, total and by type of treatment)
	Chapter 17 (5): Protection of the oceans, all kinds of seas and coastal areas	o Catches of marine species (t)	o Deviation in stock of marine species from maximum sustained yield (MSY) level (%) o Ratio between MSY abundance and actual average abundance (%) o Loading of N and P in coastal waters (t) o Algae index	
Land (6)	Chapter 10: Planning and management of land resources	o Land use change (km²)	o Area affected by soil erosion (km²)/erosion index	o Protected area as % of total land area
	Chapter 12: Combatting desertification and drought	o Fuelwood consumption per capita (m^3) o Livestock per km² of arid and semi-arid lands	o Land affected by desertification (km²)/ desertification index	
	Chapter 13: Sustainable mountain development			
	Chapter 14: Promoting sustainable agriculture and rural development	o Use of fertilizers (t/km²) o Use of agricultural pesticides (t/km²) o Arable land per capita (ha/capita)	o Area affected by salinisation and waterlogging (km²)	o Cost of extension services provided (US$) o Area of land reclaimed (km²)
Other natural	Chapter 11: Combatting	o Deforestation rate	o Change in biomass (%) o	o Reforestation rate

resources	deforestation (7)	(km²/annum) o Annual roundwood production (m³)	Timber stocks (m³) o Forest area (km²)	(km²/annum)
	Chapter 15: Conservation of biological diversity	o Rate of extinction of protected species (%)	o Threatened, extinct species (no)	o Protected area as % of total land area
	Chapter 16: Biotechnology			
Atmosphere	Chapter 9: Protection of the atmosphere	o Emissions of CO_2 (t) o Emissions of SO_x and NO_x (t) o Production of ozone destroying substances (t)	Ambient concentrations of SO_2, CO_2, NO_x and O3 in urban area (ppm)	o Expenditure on air pollution abatement (US$) o Reduction in the consumption of ozone destroying substances (% per year) o Reductions in the emissions of CO_2, SO_x and NO_x (% per year)
Waste	Chapter 21: Solid wastes and sewage-related issues	o Waste disposed (t) o Generation of industrial and municipal waste (t)		o Expenditure on waste collection and treatment (US$) o Waste recycling rates (%) o Municipal waste disposal (t/capita) o Waste reduction rates per unit of GDP (t/year)
	Chapter 19, 20, 22: Toxic chemicals and hazardous wastes	o Generation of hazardous waste (t)	o Area of land contaminated by toxic waste (km²)	

Notes to Table 1

1. Production and consumption patterns are also reflected in particular by the following indicators:
o Share of manufacturing value added in GDP (under economic)
o Export concentration ratio (under economic)
o Ratio of consumption of renewable resources over non-renewable resources
(under economic)
o Motor vehicles in use (under social)
o Household consumption of water per capita (under environmental, water)
o Fuelwood consumption per capita (under environmental, land)
o Production of ozone destroying substances (under environmental, atmosphere)
o Reduction in the consumption of ozone destroying substances (under environmental atmosphere)

2. Consultations with WHO are ongoing.

3. Consultations with HABITAT are ongoing.

4. Following the SIDS Programme of Action, indicators of vulnerability are to be developed.

5. Consultations with FAO are ongoing.

6. Consultations with FAO are ongoing for these chapters (10, 12, 13, 14).

7. Consultations with FAO are ongoing.

5.0 Environmental Indicators

The pressure-state-response framework, follows a cause-effect-social response logic. It was developed by the OECD from earlier work by the Canadian government. Increasingly widely accepted and internationally adaopted, it can be applied at a national level, at sectoral levels, at the levels of an industrial firm, or at the community level.

Pressure indicators measure policy effectiveness more directly -- whether emissions increase or decrease, whether forest depletion waxes or wanes, and whwether human exposure to hazardous conditions grows or shrinks. Accountability for the pressures each country exerts on the environment is claer -- as in the case of the amount of ozone-degrading gases emitted. These indicators are not only descriptive. They can also provide direct feedback on whether policies meet stated goals because they are based on measures or model-based estimates of actual behaviour. Pressure indicators are thus particularly useful in formulating policy targets and in evaluating policy performance. They can also be used prospectively to evaluate environmental impacts of socioeconomic scenarios or proposed policy measures.

Response indicators measure progress toward regulatory compliance or other governmental efforts, but don't directly tell what is happening to the environment. As a practical matter, data to construct indicators is usually most available for pressure indicators and sparsest for response indicators.

Core lists of environmental issues -- and of relevant indicators -- have been and are being developed by several organisations, building on the OECD's initial work. Such indicators can be organised within the pressure-state-response framework into a matrix of indicators.

Table 2 is adapted from such a matrix under consideration by UNEP (World Resources Institute, 1995).

Table 3 shows a similar matrix adapted from one being considered by the World Bank (World Resources Institute, 1995).

Table 4 is a pressure-state-response model for indicators of sustainability in land and natural resources use (Winograd, 1993)

World Resources Institute (1995) "Environmental Indicators: A Systematic Approach to Measuring & Reporting on Environmental Policy Performance in the Context of Sustainable Development", World Resources Institute, Washington, DC.

Winograd, M (1993) "Environmental Indicators for Latin America and the Caribbean: Towards Land Use Sustainability", Organisation of American States, and World Resources Institute, Washington, DC.

Table 2: Matrix of Environmental Indicators under consideration by UNEP (World Resources Institute, 1995)

Issues	Pressure	State	Response
Climate Change	(GHG) emissions	Concentrations	Energy intensity; env measures
Ozone Depletion	(Halocarbon) emissions; production	(Chlorine) concentrations; O_3 column	Protcol sign; CFC recovery; Fund contrib'n
Eutrophication	(N,P water, soil) emissions	Deposition; concentrations	Investments; sign agreements
Acidification	(SO_x, NO_x, SO_x) emissions	(VOC, NO_x, SO_x) concentrations	Recovery hazardous waste; investments/costs
Toxic Contamination	(POC, heavy metal) emissions	(POC, heavy metal) concentrations	Recovery hazardous waste; investments/costs
Urban Env Quality	(VOC, NO_x, SO_x) emissions	(VOC, NO_x, SO_x) concentrations	Expenditures; transp policy
Biodiversity	Land conversion; land fragmentation	Species abundance comp to virgin area	Protected areas
Waste	Waste generation mun'pal, ind agric	Soil/groundwater quality	Collection rate; recycling investments/cost
Water Resources	Demand/use intensity resid/ind/agric	Demand/supply ratio; quality	Expenditures; water pricing; savings policy
Forest Resources	Use intensity	Area degr frest; use/sustain growth ratio	Protected area forest, sustain logging
Forest Resources	Use intensity	Area degr forest; use/sustain growth ratio	Protected area forest, sustain logging
Fish Resources	Fish catches	Sustainable stocks	Quotas
Soil Degradation	Land use changes	Top soil loss	Rehabilitation/protection
Oceans/Coastal Zones	Emissions; oil spills; depositions	Water quality	Coastal zone management; ocean protection

Environmental Index	Pressure index	State index	Response index

Table 3: Matrix of Environmental Indicators under consideration by The World Bank
(World Resources Institute, 1995)

Issues	Pressure	State	Response
I Source Indicators 1. Agriculture a Land Quality b Other 2. Forest 3. Marine Resources 4. Water 5. Subsoil Assets a. Fossil Fuels b. Metals & Minerals	Value Added/Gross Output Human-Induced Soil Degrad Land Use Changes, Inputs for EDP Contaminants, Demand for Fish as Food Intensity of Use Extraction Rate(s) Extraction Rate(s) Extraction Rate(s)	Cropland as % of wealth Climatic Classes & Soil constraints Area, volumes, distribution; value of forest Stock of Marine Species Accessibility to Pop. (weighted % of total) Subsoil assets % wealth Proven Reserves Proven Reserves	Rural/Urab Terms of Trade In/Output ratio, main users; recyc rates % Coverage of Int'l Protocols/Conv. Water efficiency measures Material balances/NNP Reverse Energy Subsidies In/Output ratio, main uers; recyc rates
II Sink or Pollution Indicators 1. Climate Change a. Greenhouse Gases b. Stratospheric Ozone 2. Acidification 3. Eutrophication 4. Toxification	Emissions of CO^2 Apparent Consumption of CFCs Emissions of SO_x, NO_x Use of Phosphates(P), Nitrates(N) Generation of hazardous waste/oad	Atmosph. Concentr. of Greenhouse Gases Atmosph. Concentr. of CFCs Concentr, of pH, SO_x NO_x in precipitation Biological Oxygen Demand, P, N in rivers Concentr. oflead, cadmium, etc. in rivers	Energy Efficiency of NNP % Coverage of Int'l Protocols/Conv. Expenditures on Pollution Abatement % Pop. w/waste treatment % Petrol unleaded
III Life Support Indicators 1. Biodiversity 2. Oceans 3. Special Lands (eg wetland)	Land Use Changes Threatened, Extinct species % total	Habitat/NR	Protected Areas as % Threatened
IV Human Impact Indicators 1. Health a. Water Quality b. Air Quality c. Occupat'l Exposures etc 2. Food Security & Quality 3. Housing/Urban 4. Waste 5. Natural Disaster	Burden of Disease (DALYs/persons) Energy Demand Population Density (persons/km^2) Generation of industrial, municipal waste	Life Expectancy at birth Dissolved Oxygen, faecal coliform Concentr. of particulates, SO_2 etc Accumulation to date	% NNP spent of Health, vaccination Access to safe water % NNP spent on Housing Exp. on collect. & treatmt., recyc. rates

Table 4: Pressure-State-Response Model for Indicators of Sustainability in Land and Natural Resource Use (Winograd,1993)

Variable	Element	Descriptor	Indicator	Level and Scale
Population	Population Growth Density on Land Population Distribution	Measure of increase Ratio with Surface Area Urban-Rural Ratio	Total Population Density % Urban and Rural	Country, Bioregion, Region, Local Country, Bioregion, Region, Local Country, Bioregion, Region
Develop't Socio-economics	Production Increase Production Increase Purchasing Power Employment External Debt International Prices Social Welfare Health Conditions Conditions of Nutrition Condition of Education State of the Population	Measure of Increase Ratio with Population Purchasing Power Parity Level of Employment External Debt-Export Ratio Exports-Imports Price Ratio Level of Human Development Life and Mortality Expectancy Malnutrition and Calorie Intake Male and Female Literacy Population-Poverty Ratio	Annual Growth of GDP GDP per capita Real GNP per capita % of Unemployment External Debt and Debt Service as % of Exports Terms of Trade Ratio Index of Human Dev Life Expectancy and Infant Mortality Rate % of Malnourished Children and Daily Chronic Intake % of Literacy % of Incidence of Poverty	Country, Region Country, Region Country, Region Country, Region Country, Region Country, Region Country, Region Country, Region Country, Region Country, Region
Agriculture and Food	Food Production Food Production Food Consumption Agricultural Inputs Land Availability Land Concentration Production Orientation Soil	Measure of Increase Measure of Increase Measure in Calorie Intake Growth in Use of Inputs Agricultural Land and Pop Inequality of Land Distribution Grain Production and	Change in Production and Yield Index of Food Production Calories per capita and % Change in Calorie Supply Annual Fertilizer and Pesticide Use	Country, Region Country, Region Country, Region, Local Country, Region Country, Region Country, Region Country, Region Country,

	Condition Condition of Hillside Soil Condition of Hillside Soils Production Potential Land Availability Land Availability Load Capacity Production Orientation Orientation of Production	Destination Ratio Ratio with Hillside Lands Soil Limitations Soil Potential Agricultural Land, Population, and Level of Inputs Ratio Agricultural Land and Potential Population Ratio Potential and Current Agricultural Land Ratio Population Potential and Level of Inputs Ratio Production of Drugs and Employment Ratio Changes in Food Consumption	Agricultural Land per capita GINI Coefficient % of Grain consumed by livestock % of Agricultural Lands % of Soil with Limitations Potential Agricultural Land Necessary Agricultural Land Agricultural Land per capita Potential for Land Expansion Ratio of Support Capacity Production of Drugs Food Sources	Region Country, Bioregion, Region Country, Region Country, Region Country, Region Country, Bioregion, Region Country, Bioregion, Region Country, Bioregion, Region Country, Local
Energy and Materials	Production of Bioenergy Bioenergy Production Production Potential Hydroelect Resources Hydroelect Production Hydroelect Potential Hydroelect Prod Materials consumption	Firewood and Coal Prod-Pop Ratio Production and Require ratio Production of Bienergy Generation Capacity Production and Capacity Ratio Generation Potential Generation and Surface Area Ratio Consumption and Population to Surface Area Ratio	Firewood and Coal per capita Traditional Fuels as a % of Total Requirements Bioenergetic Potential Installed Hydroelect Cap % of the Capacity Gen Exploitable Hydroelct Pot Kilowatts Generated per flooded hectare Per capita materials consumption	Country, Region Country, Region Country, Region Country, Region Country, Region Country, Region Country, Region
Ecosystems and Land Use	Change in Primary Productivity Change in Land Use Employment and production Land Production Impact of Land Use Impact of Land Use	Measurement of Primary Production Measurement of the Change in Patterns of Use Relationship Among Jobs and Surface Area, People Fed Economic Production Measure of Emissions and Changes in Use Intensity Urban and Rural Emissions Relationship	Current and Natural Primary Production % Change Jobs per hectare Annual Production and Value Net Emissions, Species Used and Years of Use Equivalent People Using Fossil Fuels	Bioregion, Region Country, Bioregion, Region, Local Country, Bioregion, Local Country, Bioregion, Local Country, Bioregion, Local Country, Bioregion, Local
Forests and Pastures	Cover of Vegetation Decrease of Forests Earnings from Forests Change in Forest Surface Area Change in Forest Surface Area Production of Forests Forest Potential Forest Potential Cover of Vegetation Livestock Population Load Capacity Production of Pastures Economic Value	Type of Forest Deforestation of Dense and Open Forest Reforestation in Dense and Open Forest Annual Deforestation Ratio of Deforestation and Reforestation Relationship of Production and Population Ratio of Wood Reserves and Population Ratio of Production and Reserves Change in Surface Area of Pastures Measurement of Increase Measurement of Increase Measurement of Increase in Meat Production Ratio of Surface Area and Export Value	Surface Area of Dense and Open Forests Annual Deforestation Annual Reforestation Annual Deforestation Rate Ratio of Deforestation and Reforestation Wood Production per capita Wood Reserves per capita and by hectare Ratio of Production /Reserves % Change in Pastures % Change in Livestock Index of Load Capacity % Change in Meat Prod Dollars per hectare	Country, Bioregion, Reg Country, Bioreg, Reg Country, Bioreg, Reg Country, Bioreg, Reg Country, Bioreg, Reg Country, Bioreg, Reg Country, Bioreg, Reg Country, Bioreg, Reg Country, Bioreg, Reg Country, Bioreg, Reg Country, Local
Biological Diversity	Decrease in No Species Decrease in No Species Decrease in No Species System of Protect Areas Use of Biodiversity Risk of Species Disapp Investment in Protection Economic Value Economic Value	Ratio of Threatened Species to Total " " " " Ratio of Threatened Species to Surface Area Ratio of Protected Areas to Total Ratio of Used Species to Total Relationship of Investment and Surface Area Relationship of Investment and Surface Area Economic Production Profitability of Investment	% Threatened Animal Spe % Threatened Animal Spe Threatened Plants per 1000 km % of Protected Areas Index of Vegetation Use Index of Species Disappearance Risk Dollars per 1000 hectares Protected Value of Prod Current Net Value	Country, Region Country, Region Country, Region Country, Bioreg, Reg Country, Bioreg, Local Country, Bioreg, Local Country, Region Country, Local Country, Local
Atmosphere and Climate	Emissions of Greenhouse Gasses Emissions of	Increase in Emission Through Change in Land Use Increase	Emissions of CO Es Carbon Total and per capita	Country, Bioreg, Reg Country, Region

	Greenhouse Gases Emissions of Greenhouse Gases Emissions of Greenhouse Gases	in Total Emissions Relationship of Activities and Change in Land Use Ratio of Current and Accumulated Emissions Incidence of Natural Disasters	Emissions of CO Es Carbon Total per capita and per GNP Emissions of CO Eq Carbon by Activity Current and Accumulated Emissions of CO per cap Population, Affected and Economic Losses	Bioregion, Region Country, Region Country, Region
Information and participation	Environmental information Societal Participation Public Option	Countries with Environmental Profiles and Inventories Possibility of Participation in Decisions Importance of Environment	No of Environmental Profiles and Inventories No of NGOs per Area of Activity Perception of Environmental Problems	Country, Region Country, Region Country, Region
Treaties and Agreements	Environmental Policy Sources of Financing for Conservation	Participation in Treaties and Agreements Debt-for-Nature Swaps	Signing and Ratification of International Treaties Funds Generated for Conservation	Country, Region Country, Region, Local
Land Use Projections	Land Use Potential Land Need Current and Potential Use Vegetation Land Use Consequences of Land Use Cost and Investment for Development Potential Land Use	Ratio of Potential Productive Land to Population Ratio of Needed Agricultural Land to Level of Inputs Ratio of Current to Potential Productive Land Ratio of Land Use to Pop Additions to Greenhouse Gases Ratio of Necessary Surface Area and Cost of Land Use Ratio of Actual to Potential Use Cost	Potential Productive Land per capita Agricultural Land Necessary in 2030 Index of Land Use Deforestation Rate and Ratio of Re/Deforestation Agricultural Land and Forests per capita Net, total, and per capita Additions Net, Total, and per capita additions Average Annual invest Cost and Benefit of Rehabilitation	Bioregion, Region Bioregion, Region Bioregion, Region Bioregion, Region Bioregion, Region Bioregion, Region Bioregion, Region Bioregion, Region Bioregion, Local
Agro- forestry	Potential for Mitigating the Consequences of Land Use	Ratio of Potential Surface Area to Absorption of Carbon	Carbon Absorption through Reforestation and Agroforestry	Bioregion, Local

6.0 Indicator Sources

Social Indicators of Development contains data for assessing human welfare to provide a picture of the social effects of economic development. Data are presented for more than 170 economies. Up to 94 indicators are reported for each country including: size, growth, and structure of population; determinants of population growth; education and illiteracy; natural resources; and transport and communication. The data set is available at the following URL:

http://www.ciesin.org/IC/wbank/sid-home.html

Trends in Developing Economies (TIDE) provides brief reports on most of the World Bank's borrowing countries. This compendium of individual country economic trends complements the World Bank's World Development Report. The data set is available at the following URL:

http://www.ciesin.org/IC/wbank/tde-home.html

Habitat II Indicators (refer to Table 5) lists a framework of indicators for analysing Urban and Human Settlement Conditions, developed for the United Nations Conference on Human Settlements (known as Habitat II), which was held in Istanbul in June 1996.

Table 5: Habitat II Indicators for Urban & Human Settlements

MODULE O :- BACKGROUND DATA

Indicator DA1: Birth and death rates

Crude birth and death rates are defined as births and deaths per 1000 population.
Indicator DA2: Migration rates
Net migration : (A) within country, (b) overseas, (c) total
Indicator DA3: Household type
Number of households with (a) more than one adult and children, (b) single parent households, (c) more than one adult, no children, (d) one person only
Indicator DA4: Household expenditure
Proportion (%) of average household income spent on: (a) food, (b) housing, (c) travel, (d) other
Indicator DA5: Dwelling type
Number of: (a) detached dwellings, (b) medium density dwellings, (c) apartments, (d) total

URBAN INDICATORS

MODULE 1 :- SOCIO-ECONOMIC DEVELOPMENT

POVERTY
Indicator A1: Illiteracy of poor
Defined as the percentage of poor aged 15 and over who are illiterate
Indicator A2: Daily kilojoule supply of poor
Defined as the ratio of average food Calories consumed by poor to the average number of Calories needed to sustain a person at normal levels of activity and health
Indicator A3: Malnourished children under five
Defined as the percentage of children, from one to five years of age who are more than two standard deviations from the median weight for age of the reference population (or WHO standards).
Indicator A4: Social safety net
Support to the population provided by the city locally or nationally.

EMPLOYMENT
Indicator A5: Unemployment rates by sex
Defined as the average proportion of unemployed during the year, as a fraction of the (formal) workforce, by sex.
Indicator A6: Employment growth
Defined as the average annual growth rate of the number of (formally) employed men and women, aged 15 and above, during the last 5 years.
Indicator A7: Child labour
Defined as the number of employed or economically active persons under 15 years of age.
Indicator A8: Minimum wage coverage
Defined as the proportion of the economically active population whose wage or salary income is covered by minimum wage legislation.

PRODUCTIVITY Indicator A9: City investment
Defined as gross capital formation in the city, divided by city product.
Indicator A10: Airport activity
Defined as the average monthly number of passengers having used the airport (both for departure and arrivals) during the year.

HEALTH AND EDUCATION
Indicator A11: Expenditure on social services
Defined as the total expenditure, both capital and recurrent, public and private, on social services in US dollars per person.
Indicator A12: Life expectancy at birth
Defined as expected number of years till death for a new-born child.
Indicator A13: Infectious diseases mortality
Defined as the proportion of deaths due to infectious diseases.
Indicator A14: School enrollment rates
The percentage of children of eligible age, by sex, who are enrolled in: (a) primary school, (b) secondary school.
Indicator A15: Adult literacy rate
Defined as proportion of adults who can read and write a simple paragraph about their everyday life.
Indicator A16: Tertiary graduates
Defined as the proportion of male graduates in all adult males, and female graduates in all adult females.

SOCIAL INTEGRATION

Indicator A17: Refugees
　　　Defined as percentage of the population who are refugees.
Indicator A18: Deaths due to violence
　　　Defined as the proportion of deaths in the city in the past three years that have occurred as a result of violence.

MODULE 2 :- INFRASTRUCTURE

ACCESS AND AFFORDABILITY
Indicator A19: Cost to household income ratios
　　　Defined as median expenditure on services divided by median household income or (a) water, (b) sewerage, (c) electricity.

WATER
Indicator A20: Source of water
　　　Percentage of households obtaining water as a primary source from: (a) piped connection, (b) communal tap, (c) vendor or truck, (d) well, stream, lake or dam, (e) others.
Indicator A21: Piped water supply reliability
　　　Defined as average number of hours per year that households in the city are without piped water.
Indicator A22: Water leakage
　　　Defined as percentage of piped water unaccounted for and lost through leakage, seepage or unauthorised use.

SEWAGE
Indicator A23: Sewage disposal
　　　Proportion of households with the following types of latrine facilities: (a) sewerage pipe, (b) underground individual, (c) underground communal, (d) pan collection, (e) open ground or trench, (f) other.
Indicator A24: Public latrines
　　　Defined as the number of public latrines per 10000 population.

ELECTRICITY
Indicator A25: Electricity price
　　　Defined as the price of electricity in US dollars per kwh.
Indicator A26: Line losses
　　　Defined as percentage of power supplied to the city that is unaccounted for or lost before reaching final destination.
Indicator A27: Capacity to load ratio
　　　Defined as peak load to certified capacity ratio.

TELEPHONE
Indicator A28: Call completion rate
　　　Defined as proportion of calls made which connect and are not interrupted.

INFRASTRUCTURE OPERATIONS
Indicator A29: Operating to staff ratios
　　　Defined as proportion of operating costs spent on staff, for all authorities providing the following services in the metropolitan area: (a) water, (b) sewerage, (c) electricity.
Indicator A30: New connections to staff ratios
　　　Defined as number of new connections per annum divided by number of staff in supplying authorities for the following services (a) water, (b) electricity, (c) telephone.
Indicator A31: Revenue to operation cost ratio
　　　Defined as percentage of all operating costs met from own-source revenues in the following services: (a) water, (b) sewerage

MODULE 3 :- TRANSPORT

GENERAL
Indicator A32: Transport facilities
　　　Defined as the proportion of deaths per thousand in the last year from transport related causes.
Indicator A33: Fuel price
　　　Defined as the price in US cents per litre, including tax, of: (a) petrol (gasoline), (b) diesel, (c) LPG or CNG.
Indicator A34: Transport household budget share
　　　Proportion of total household income spent on all forms of travel by: (a) all households, (b) poor households.
Indicator A35: Transport fuel consumption
　　　Defined as the annual number of litres per person of transport fuel (excluding aviation fuel) consumed.

ROAD INFRASTRUCTURE
Indicator A36: Length of road per vehicle
Defined as total length of roads in km divided by total number of road vehicles, for (a) surfaced roads, (b) unsurfaced roads
Indicator A37: Road congestion
Defined as the proportion of roads with Volume/Capacity >0.8 during peak hour

ROAD VEHICLES
Indicator A38: Vehicles failing emission standards
Defined as proportion of road vehicles which do not meet local emission standards
Indicator A39: Automobile fuel consumption
Average fuel consumption in litres per 100 km for automobiles for: (a) the whole fleet, (b) new cars.
Indicator A40: Pedestrians killed
Defined as proportion of road fatalities who are pedestrians.

PUBLIC TRANSPORT
Indicator A41: Public and mass transport seats
Defined as number of public transport seats per 1000 population.
Indicator A42: Cost recovery from fares
Defined as the ratio of fares collected by public transport authorities to operating costs.

MODULE 4 :- ENVIRONMENTAL MANAGEMENT

AIR QUALITY
Indicator A43: Air pollution concentrations
Number of days per annum that WHO standards are exceeded, an average annual measured concentrations for the following pollutants: (a) SO_2, (b) NO_x, (c) CO, (d) O_3, (e) SPM, (f) Pb
Indicator A44: Emission per capita
Total emissions in tonnes per capita per annum of: (a) SO_2, (b) NO_x, (c) CO_2
Indicator A45: Acute respiratory deaths
Defined as percentage of deaths due to acute respiratory disease

WATER
Indicator A46: Percent of DOB removed
Defined as average fraction of BOD removed in major wastewater receiving bodies
Indicator A47: Cost of wastewater treatment
Defined as average cost in US dollars per cubic metre of water treated
Indicator A48: Lowering of groundwater table
Defined as the lowing of the groundwater table in cm in the past year
Indicator A49: Waste water recycled
Defined as percentage of waste water re-used as 'grey water' for industrial processes or similar
Indicator A50: Level of treatment
Per cent of water subject to (a) primary treatment, (b) secondary treatment, (c) tertiary treatment

SOLID WASTES
Indicator A51: Biodegradable waste
Defined as percentage of all solid waste which is bio-degradable (composed of organic matter)
Indicator A52: Recycling rate
Percentage of (a) paper, (b) glass, and (c) aluminium disposed which are recycled.
Indicator A53: Average cost of waste disposal
Defined as cost in US dollars per tonne of solid waste disposal, for those wastes which are formally disposed through refuse collection.
Indicator A54: Cost recovery
Defined as percentage of costs of formal waste disposal which is recovered as charges from producers of the waste.
Indicator A55: Industrial waste generation
Generation per capita per annum of: (a) industrial wastes, (b) toxic wastes, (c) ratio-active wastes.

RESOURCES DEPLETION
Indicator A56: Energy usage per person
Defined as the total energy usage per annum per person in metric tonnes of coal equivalent.
Indicator A57: Fuelwood usage
Defined as fuelwood usage in tonnes per person per annum

Indicator A58: Renewable energy usage
Defined as proportion of energy derived from renewable sources (hydro, wind, geothermal and solar electricity, combustion of animal wastes, fuelwood where this is being replaced through reforestation).

Indicator A59: Food consumption
Defined as daily Calorie consumption per person.

DISASTER MITIGATION

Indicator A60: Disaster mortality
Defined as proportion of deaths during last ten years which are due to natural disasters.

Indicator A61: Housing on fragile land
Defined as the number of dwellings in the city which are located on land which is subject to natural disasters.

Indicator A62: Fatal industrial accidents
Defined as number of deaths from industrial accidents during last year.

URBAN ENHANCEMENT

Indicator A63: Green space
Defined as percentage of green space in built up area.

Indicator A64: Monument list
Defined as number of buildings in city on heritage or monument lists.

MODULE 5 :- LOCAL GOVERNMENT

Indicator A65: Change in real per capita total revenue
Average annual change in real per capital income over a three-year period.

Indicator A66: Change in real per capital own-source revenues
Defined as average annual change in real per-capita own-source revenues over a three-year period.

LOCAL PARTICIPATION

Indicator A67: Elected and nominated councillors
Defined as total number of elected and of nominated local government representatives by sex, per 10000 metropolitan population, by sex.

Indicator A68: Voter participation rates, by sex
Defined as percentage of adult population (having reached voting age) who voted in the last municipal election.

Indicator A69: Number of associations per 10000 population
Defined as number of voluntary non-profit organisations, including NGOs, political sporting or social organisations, registered or with premises in the city, per 10 000 population.

Indicator A70: Citizen involvement in major planning decisions

Indicator A71: Decentralised district units
Defined as number of separate local governments or administrative units (quarters, wards, regions or similar) which are responsible for provision of more than two local services.

HOUSING INDICATORS

MODULE 6 :- AFFORDABLE AND ADEQUATE HOUSING

ACCESS TO AFFORDABLE HOUSING

Indicator HA1: Mortgage affordability
Defined as proportion of households who are eligible for and can afford the maximum loan on a median priced formal sector house.

Indicator HA2: Excessive housing expenditure
Defined as proportion of households in the bottom 40% of incomes who are spending more than 30% of their incomes on housing.

Indicator HA3: Economic share of housing
Defined as the proportion of national or city product due to rent or imputed rent of dwellings.

Indicator HA4: Transaction costs
Defined as proportion of the value of a median-priced formal sector house which must be spent to both buy and sell the house.

Indicator HA5: House price appreciation

Defined as the average annual real percentage of change of house prices over a five year period.

ADEQUATE HOUSING FOR ALL
Indicator HA6: Overcrowding
Defined as the percentage of households who are in housing deemed to have too few bedrooms for a family of that type.
Indicator HA7: Households per dwelling
Defined as the ratio between the total number of households and the total number of occupied dwelling units of all types in the urban area.
Indicator HA8: Inadequate housing
Defined as the proportion of dwellings that are deemed to be inadequate or in need of major repairs.
Indicator HA9: Indoor plumbing
Defined as the percentage of dwelling units which contain a complete unshared bathroom within the unit.
Indicator HA10: Squatter housing
Defined as the percentage of the total housing stock in the urban area which is currently occupying land illegally.
Indicator HA11: Homelessness
Defined as the number of people per thousand of the urban area population who sleep outside dwelling units (eg on streets, in parks, railroad stations and under bridges) or in temporary shelter in charitable institutions.
Indicator HA12: Owner occupancy (by sex)
Defined as the percentage of households which own the dwelling units which they occupy for (a) all households, (b) female headed households.
Indicator HA13: Vacant dwellings
Defined as the percentage of the total number of completed dwelling units which are presently unoccupied.

RURAL HOUSING
Indicator HA14: Rural water/electricity connection
Defined as the percentage of rural dwelling units with a water or electricity connection in the plot they occupy.
Indicator HA15: Permanent rural housing
Defined as the percentage of rural dwelling units which are likely to
last twenty years or more
given normal maintenance and repair, taking into account locational and environmental hazards (eg floods, typhoons, mudslides, earthquakes).
Indicator HA16: Rural home ownership
Defined as the percentage of rural residents who own their dwellings.
Indicator HA17: Rural house price to income
Defined as the ratio of the median free-market price of a rural dwelling unit and the median annual rural household income.

MODULE 7 :- HOUSING PROVISION

LAND
Indicator HA18: Land availability
Defined as the number of serviced blocks currently available divided by the present construction rate in dwellings per month (annual average).
Indicator HA19: Planning permission multiplier
Defined as the ratio between the median land price of an unserviced plot on the urban fringe given planning permission for residential development, and the median price of a nearby plot in rural/agricultural use without such permission.
Indicator HA20: Formal land transaction
Defined as the percentage of the metropolitan area covered by a land registration system which allows for buying, selling, long-term leasing, or mortgaging urban land.
Indicator HA21: Development time
Defined as the median length in months to get approvals, permits, and titles for a new medium-sized (50-200 unit) residential subdivision in an area at the urban fringe where residential development is permitted.
Indicator HA22: Cost recovery
Defined as the percentage of total infrastructure costs recovered from new developments during the year.
Indicator HA23: Minimum lot size
Defined as the minimum lot size for a single family housing unit in a new 50-200 unit residential subdivision.
Indicator HA24: Land development controls
Defined as a composite of questions on land use and building code regulations.

FINANCE
Indicator HA25: Credit to value ratio
Defined as the ratio of new mortgage loans for housing last year to total investment in housing (in both the formal and

informal sectors) last year.
Indicator HA26: Housing loans
Defined as the proportion of dwellings that have housing loans from the formal financial sector.
Indicator HA27: Mortgage-to-prime difference
Defined as the average difference in percentage points between interest rates on mortgages in both commercial and government financial institutions and the prime interest rate in the commercial banking system.
Indicator HA28: Mortgage-to-deposit difference
Defined as the average difference in percentage points between interest rates on mortgages in both commercial and government financial institutions and the interest rate on one-year deposits in the commercial banking system.
Indicator HA29: Arrears rate
Defined as the percentage of mortgage loans which are three or more months in arrears in both commercial and government financial institutions.
Indicator HA30: Mortgage loans for women
Defined as the percentage of mortgage loans granted to women to all mortgage loans made last year.

CONSTRUCTION
Indicator HA31: Construction cost
Defined as the present replacement cost (labour, materials, on-site infrastructure, management and contractor profits) per square meter of a median priced dwelling unit.
Indicator HA32: Construction time
Defined as the average time, in months, required to construct a median housing unit.
Indicator HA33: On-site productivity
Defined as the man-hours per square metre on a typical median-priced dwelling in the formal construction sector.
Indicator HA34: Industry concentration
Defined as the percentage of new formal-sector housing units placed on the market by the five largest developers (either private or public) last year.
Indicator HA35: Employment
Defined as the percentage of all employment that is engaged in the construction of residential dwelling units.
Indicator HA36: Wage labour
Defined as proportion of on-site building employees who are employed as wage labour.

TAXES AND SUBSIDIES
Indicator HA37: Effective taxation rate by tenure
Defined as the nett annual housing-related taxation per dwelling paid by households to governments, in US dollars, for (a) owner occupied housing, (b) private rental housing, (c) public housing.
Indicator HA38: Nett housing outlays by government
Defined as the total expenditure by all levels of government on housing in the current year, nett of all housing related receipts from the public, taken as a percentage of total government expenditure.
Indicator HA39: Property tax rate
Defined as the percentage of the market value of the median-priced dwelling unit which is collected as annual property tax.

PUBLIC HOUSING
Indicator HA40: Public housing stock
Defined as the percentage of the total number of dwelling units in the urban area that is owned, managed and controlled by the public sector.
Indicator HA41: Privatised public stock
Defined as the percentage of the total number of dwelling units previously constructed or managed by the public sector hat have been privatised.
Indicator HA42: Public housing production
Defined as the total production of public housing units as a fraction of all formal housing units produced during the year.
Indicator HA43: Social rent to income
Defined as the ratio of the median annual rent of a public housing dwelling unit and the median household income of renters of public housing.
Indicator HA44: Waiting time
Defined as the average time on waiting lists before allocation of public housing units.
Indicator HA45: Operating subsidies
Defined as the ratio of rent payments to operations costs for public housing.
Indicator HA46: Administrative costs
Defined as the administrative cost of operating public housing taken as a fraction of the estimated market rental value of the dwellings.
Indicator HA47: Tenant management
Defined as proportion of social housing stock managed by tenants, completely, partly or jointly.