Report on

Indicator related research for Kitakyushu Initiative

Dr. Shobhakar Dhakal
Institute for Global Environmental Strategies (IGES)
Kitakyushu Office, 3-9-30, Asano, Kokurakita-ku, Kitakyushu 802 0001, Japan
Tel: (+81) 93 513 3711, Fax: (+81) 93 513 3712, e-mail: dhakal@iges.or.jp

This report consists of four parts

Part I: **Policy Based Indicator Systems: emerging debates and lessons**

Part II: **Preliminary framework and list of Indicators for Assessment of Urban Environmental Sustainability**

Part III: **Preliminary study for assessing the prospects of designing indicator system for Kitakyushu Initiative**

Part IV: **Prospective list of urban indicators**

Indicator Research-Part I

Policy Based Indicator Systems: emerging debates and lessons

Abstract

Constructing the policy-based indicator systems is increasingly becoming popular. This paper describes the major existing indicator initiatives at global, national and local levels and analyzes some of the salient features of selected indicator initiatives. The paper emphasizes the weakness of the PSR (Pressure-State-Response) framework and needs for further research on the methodological issues of measuring sustainability. With the notion of sustainability gaining momentum, the trends of constructing sustainability indicators are becoming popular at global, national and local scale. Agenda 21 has added a new dimension in it. Traditionally top-down or expert-driven indicator initiative's dominance prevailed, however, after the emergence of Local Agenda 21 and after grass-root organizations gaining increasingly importance, bottom-up approached are catching more attention. This paper has touched upon many debates in indicator initiatives and addressed issues such as: common vs different indicators, simple vs complex indicators, quantitative vs qualitative and so forth. Bridging the gap on those debates, the paper argues that any such approaches are useful provided they are fruitful and meet the original goal, and it also emphasizes the importance of the stakeholder-participation in indicator making process to bridge those gaps.

Introduction

Indicator or a group of indicators is a tool that can perform variety of the tasks. Merriam-Webster's dictionary defined "Indictor" as the 'one that indicates'. The obvious question is 'what it indicates'? In the context of the economy, the same dictionary defines indicator as 'any of a group of statistical values that taken together give an indication of the health of the economy'. However, an indicator not necessarily has to be statistical or quantitative, it could be of qualitative nature too. OECD (1993) defines indicator as a parameter or a value derived from parameters which provides information about a phenomenon. In that meaning, indicators help to reduce the number of measurements and parameters to provide "exact" representation of a situation. The choice of a group or a single indicator depends on variety of factors and requirement. In general, accuracy of a single composite indicator depends on weighting techniques and the level of aggregation, among others. Urban Indicator Program (UNCHS, 1997) defines, "Indicators are not data, rather they are models which simplify a complex subject to a few numbers that are easy to grasp and to understand by policy makers". Gross domestic product (GDP), Human Development Index (HDI) and several other singles but powerful indicators exist today that play important role in the development process. More recently, indicators have been widely used to keep track of the progress towards sustainability and efforts have been made to assess sustainability at different levels and scales by sustainability indicators.

The relevancy, use and choice of indicators have been questioned at various levels and places (Brugman, 1997; Bell and Morse, 2001; Pinfield, 1996, Burgman, 1994, Maclaren, 1996). In spite of such questions, many indicator making efforts are continued addressing sector specific issues to whole economy and local to global scale. Less efforts have been made in the past literatures to present a comprehensive review of the existing international indicator initiatives in a holistic way. Studies on the selected aspects, such as methodology of aggregation and weighing techniques are done on many occasions (Kline, 2000; UNCSD, 2001). A holistic analysis would be useful for the future initiatives to avoid some of the shortcoming of the past. This paper begins with so-called "Social Indicator Movement". It briefly mentions some of the

major international indicator initiatives at the local and national (or global) scale. A review of the selected top-down indicator systems is done and a brief investigation into the essential element of such system is carried out. Some of the methodological shortcomings of the current approaches are highlighted and major debates and controversies are discussed. Bridging the gaps on those debates, the lessons learned from the past initiatives are described in this paper. This paper tries to be holistic in approach.

Boom in social indicator movement

A surge of interest in using indicators to address the variety of the social problems has been observed around the world since last few decades and at least after 1970. Manson and Gillbert (1991) has termed it as 'Social Indicator Movement'. The worldwide attention on the notion of the sustainability got new thrust after the Bruntland Commission's report, Our Common Future (WCED, 1987). It is important to point out here that Bruntland Commission did not invent the concept of sustainability. The concept of sustainability existed before the Commission was instituted, such as in IUCN's world Conservation Strategy (IUCN, 1980) and other similar publications. However, Bruntland Commission provided one of the convincing definitions of sustainability and general framework by addressing the inter-generation and intra-generation equity. This inter-generation and intra-generation equity involved the use and exploitation of natural resources and environment, among others. Indeed, the notion of sustainability got a new phase after Bruntland Commission report. Since then, efforts have been made to construct the indicators of sustainability at national and local scales. United Nations Commission on Sustainable Development (UNCSD) is carrying out work on Sustainable Development Indicators for monitoring and promotion of the implementation of Agenda 21. United Nations Commission on Human Settlement (UNCHS) has developed a common set of key urban indicators (UNCHS, 1997), primarily for monitoring progress of attaining objectives of Habitat Agenda (that put greater emphasis on housing and shelter related issues). IUCN and International Development Research Center (IDRC)'s Barometer of Sustainability measures society's well being and progress towards sustainability (Moldan and Billharz, 1996). A detail description of other national sustainability indicators is given in Moldan and Billharz (1996).

Numerous other international indicator initiatives exist today. Healthy Cities Project of World Health Organization (WHO) has been involved in the development and use of a set of core indicators to carry out the inter-city comparison on progress toward a healthy city (WHO, 1997; Waddell, 1995). A number of past and ongoing Canadian indicator initiatives are reported at national and local level, particularly, Ecosystem Approach to Human Health Program (Forget and Lebel, 2001) of IDRC and Ecosystem Health Indicators of International Joint Commission, among others. More recently, many countries and cities are putting together State of the Environment Report using a set of quantifiable indicators independently or with assistance from bilateral and multilateral agencies. In the implementation of the Local Agenda 21, many local authorities have developed or are interested to develop the indicators to measure the progress towards the sustainability. In more developed cities, local effort for using indicators in Local Agenda 21 related activities are reported, which include Seattle's Sustainable Seattle Project (Brugman, 1997), Toronto's Healthy City Project (McMullan, 1997), Jacksonville's Quality of Life Initiative (Pinfield, 1996) and many other local initiatives of Europe and North America. They address an interesting community driven method to seek local solutions to the urban problems. In this context, European Union's Local Sustainability Indicators (EU, 2000) seek to apply a common set of indicators to evaluate Local Sustainability in 91 cities of Europe and implementation of these indicators are at testing phase.
At national scale, Gross Domestic Product (GDP) and Unemployment Rate are widely used indicators to assess the health of an economy although they have severe limitations for measuring the wellbeing of a nation. United Nation Development Program (UNDP)'s Human Development Indices (HDI) contributed a step closer towards assessing the national well being by addressing education and health along with economic factors (HDI, 2000). However, both GDP and HDI do not take into account the natural resources, environmental problems, institutional and social issues that are linked to sustainability. Policy

Performance Index (PPI) of European Commission aims to replace GDP and Unemployment Rate by a policy based indices based on environmental, social and economic factors but comprehensive work are carried out only for environmental indices so far (Source). Similarly, Genuine Progress Indicator (GPI) of Redefining Progress seek to improve GDP by accounting some of the externalities such as crime, income distribution, pollution, leisure and volunteer time and family breakdown, among others (Cobb et al., 1999). In essence, GPI corrects GDP by subtracting social bads and by adding the value of unpaid services.

In the context of the environmental policy, planning, and management, the major use of the indicators has been used to assess the historical evolution, state of the environment, and to keep track of changes in the environment for the purpose of providing feedback to policy makers. Quiet often, indicators are used to evaluate the environmental process, performance reviews, policy outcomes, and to inform public for raising awareness. Any environmental policies will have to take place in the sectoral policies of an economy in an integrated way. Therefore, the chosen indicators should be able to capture the factors responsible for the integration of the environmental concerns into other sectoral policy. Keeping such view, Organization of Economic Cooperation and Development (OECD) finalized a core set of environmental indicators in 1992 (OECD, 1993; OECD, 1997). OECD has also derived indicators for natural resources, environmental expenditure accounts and various sectors (transport, energy, agriculture, etc.) apart from the core set of indicators, and these environmental indicators are updated every two years (OECD, 2001). Similarly, World Economic Forum (WEF)'s Environmental Sustainability Index provides ranking of countries in terms of its indices (WEF, 2001). At city scale, People's Republic China's State Environmental Protection Administration (SEPA) has constructed a set of indicators to assess the environmental performance of its cities that acts as a reward based incentive mechanism to cities (SEPA, 2000). A number of indicator initiatives exist at World Bank's activities. World Bank has been publishing more than 600 indicators in its World Development Indicators on yearly basis for more than 150 countries and regions (WB, 2001). In 1999, World Bank first issued its Environmental Performance Indicators for monitoring project performance and impacts covering key environmental areas (WB, 1999) however, weighing, valuation and aggregation of indicators for making one or few comprehensive indices are yet not reported. It should be mentioned here that the focus of World Bank type initiative is different from UNCSD type because World Bank primarily deals with development projects rather than the concept of sustainability which is obscure yet.

In the area of natural resources and ecology, *Ecological Footprints* has caught worldwide attention since its publication (Wackernagel and Rees, 1996). Ecological Footprint is the measure of ecological carrying capacity and human impact on the earth. This is based on the calculation of inputs and wastes with the productive capacity of earth. World Wide Fund for Nature Conservation (WWF)'s Living Planet Index measures the changes in the of world's natural ecosystem since 1970 for three major ecosystems, i.e. forest, freshwater and marine (WWF, 2000). This is not a complete list of indicator initiatives. A wide range of indicators is in use throughout the world. Each indicator system has its own peculiar need and therefore has own approach and methodology. International Institute of Sustainable Development (IISD) has developed a Compendium of Sustainable Development Indicator Initiatives that contains links to various such indicator initiatives (http://iisd.ca/measure/compindex.asp). Similarly, a useful list of development indicators is hosted by Institute of Development Studies, Sussex.
(http://www.ids.ac.uk/eldis/hot/indicator.htm) for more information on various indicator initiatives.

Elements of the indicator system

An analysis on the salient features of selected indicator systems were carried out, in particular, following indicator system were revisited,

Indicators of Sustainable Development of UNCSD (UNCDS, 2001)

Environmental Sustainability Index of WEF (WEF, 2001)
Policy Performance Indices (PPI) of EC (EC, 1997; Jesinghaus, 1999)
Core Set of Indicators for environmental performance review of OECD (OECD, 1993)
Environmental Performance Indicators of World Bank (WB, 1999)
Healthy Cities Core Indicators of WHO (WHO, 1997)
Urban Indicators of UNCHS (UNCHS, 1997)
Local Sustainability Indicators of EU (EU, 200)
Urban Environmental Quality Examination System of SEPA/PRC (SEPA, 2000)

These indicator systems follow basically expert driven or so-called 'top-down' approaches. The important elements of these indicator systems that are common and unique are identified. The indicator systems discussed above are different in scope, indicator type, objective, issue coverage and methodology. Firstly, the scope and objectives of the indicators systems are different; some address sustainability in general, others address environment (or other sectors) in particular; some address issues at national or global scale while others address issues at local scale. Secondly, the types of indicators are different. Some construct a single aggregated composite index that is cross country/city comparable, while others construct a set of indicators with no aggregation. Qualitative indicators are also used in some of these indicator systems. Few indicator systems are also found to use "qualitative impressions" with the help of color codes signifying the situation from "very good" to "very bad". The aggregation techniques used in constructing an index are unique in terms of weighting and valuation. Thirdly, the objectives of the indicator systems are different. The UNCSD and UNCHS indicators follow their agenda, i.e. Agenda 21, and Habitat agenda, respectively. Their objective is to monitor the implementation of their agenda. Some indicator systems try to assess the performance of the city/nations in terms of the environment, some try to provide the rating or comparison, and some even attempt to replace existing indicators such as GDP, unemployment rate etc. There are other objectives such as reporting to public, evaluating the performance of their programs and projects, measuring the progress towards the sustainability, among others. Fourthly, the issue framing is different. Usually, identifying the relevant issues to be addressed by the indicators is difficult task because those issues should be able to describe the progress towards sustainability, environment or the area that is of interest to the indicator system. Some indicator system issues are agenda based, such as UNCSD where issues are framed by following the chapters of Agenda 21. Some issues are identified based on chains of cause-and-effect relationships of environmental, social or economic impact. In case of environment, some follow physical phenomenon such as air, water etc or the economic sectors, while others prefer action-based approach. In case of sustainability, emphasis is given usually to multi-layer discussions amongst the experts and stakeholders to identify the issues. Finally, the methodological framework is key to any indicator system. So far, most of indicators systems followed Pressure-State-Response (PSR) framework or some of its derived form, such as Driving force-State-Response (DSR), Driving force-Pressure-State-Impact-response (DPSIR) etc. Urban Indicators of UNCHS, partly, and performance evaluation indicators of World Bank, fully, used the policy development cycle and project cycle framework respectively. Such diversities in various essential elements of the indicator systems, described above, have given uniqueness to each indicator system.

Methodological questions

A survey of the methodologies used in the past indicator initiatives was carried out in this study. DPSIR framework is found to be used widely for constructing the indicator systems. DPSIR framework has been used in variety of its forms such as omitting one or more components or adding components in DPSIR (such as exposure, vulnerability etc.). In this technique, isolated chains of cause and effect are identified for each issue or problem and indicators are allocated to each cause and effect. Figure 1 describes such phenomenon applied to the areas of environment, however such approach can be used at different scopes and scales.

Another indicator framework widely used for evaluating the performance at project-level activities is based on the Project Cycle (WB, 1999). World Bank, in particular, follows this approach for constructing environmental performance indicators as environmental consequences of the development projects are usually a topic of serious debates. This framework is very much project-specific and deals with only one activity at a time. However, there could be several indirect implication of the project by using input resources indiscriminately that the framework fails to account for. Input resources such as construction materials can be liked with the considerable "embedded" environment problems in over consumption of natural resources and environmental problems during its production. Resources such as wood, and natural resources extracted from immediate surroundings have direct environmental implications. However, how much should we expect by the project-level activities to promote overall sustainability or environmental sustainability is an open question to be answered.

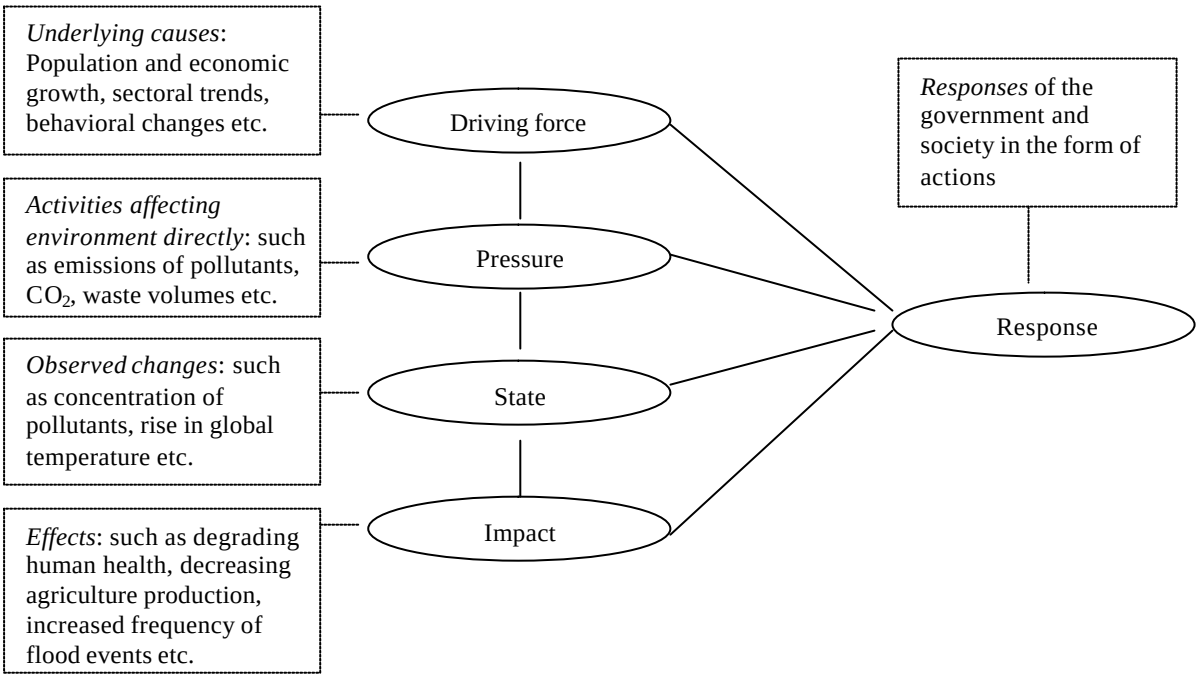


Figure 1. DPSIR Framework

For selected policies, Policy Development Cycle may offer a useful framework for policy performance indicators. The components of Policy Development Cycle are, policy objectives, various means and essential elements of policy implementation, monitoring of the policy implementation, intermediate policy evaluation, assessment of the policy outcomes, and the assessment of the whole policy. Such an assessment provides feedback to every aspect of the policy. In this method, the assessment criteria are fixed and indicators are allocated to these criteria. Some of these criteria are listed below:

- Effectiveness: effectiveness of the target, achievement of target, etc.
- Economic efficiency: employment, investment, cost benefit analysis etc.
- Resources efficiency: Resources intake minimization, productivity
- Equity: Egalitarian distribution of benefits
- Impacts on other sectors: socio-economic impacts, integrated issues, social acceptability
- Sustainability of the policy
- Partnership and participation of the stakeholders
- Pioneering spirit, transferability of the approach

- Lessons learned

Although DPSIR framework is widely used, it has several limitations. DPSIR framework has been criticized for its inability to neglect the systemic and dynamic nature of various processes of causes and effects. Firstly, the "effect" and "impact" mechanisms are complex and cannot be isolated into a single cause and effect. Such isolation of causes and effects into separate chains are very simplistic assumptions of the complex problem. There could be considerable relationship between the causes themselves and effects themselves and such structural dependency cannot be addressed by DPSIR framework. Secondly, impact can become either pressure or state depending on the chains, and thirdly, multiple pressures and impacts are not considered (this is not the exhaustible list of shortcomings) (Bossel, 1999; Meadows, 1998). Bossel (1999) illustrated general shortcoming of DPSIR model by a simple example, which is depicted graphically in figure 2.

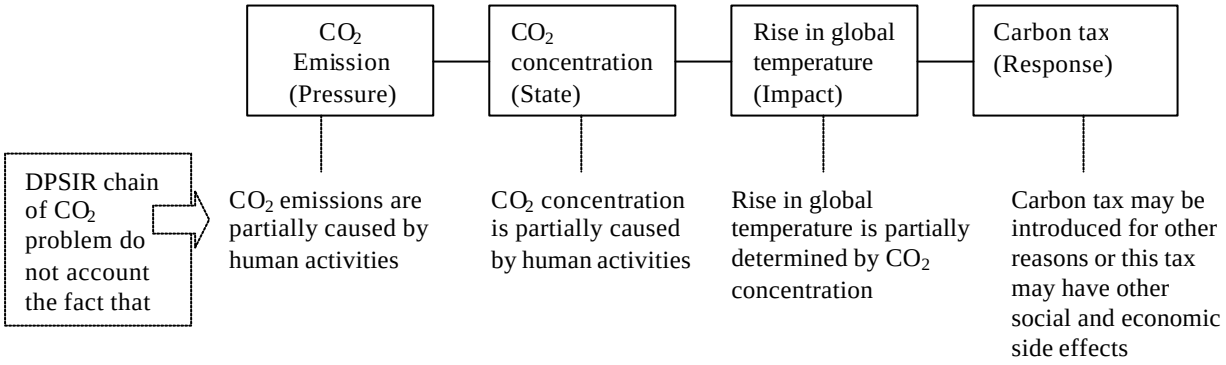


Figure 2. Limitations of DPSIR Framework, an example of CO2 emissions

Realizing the shortcoming of existing approaches to address the broad area of sustainability, few efforts are focussed on the systems approach. Systems approach helps to root-out the limitations that were discussed earlier in DPSIR approach. In this approach, a comprehensive model of the total system is built incorporating the important components of such system. The major tasks are therefore, to identify the major systems, to develop the approach to identify indicators of sustainability of these systems and to assess the sustainability at different levels of societal organization (Bossel, 1999). Systems approach avoids selecting indicators by trial-and-error or ad hoc method. The ad hoc selection may lead to the potential bias in selection of the indicators towards the interests of the authors. Three major systems identified in systems approach are human system, support system and the natural system. There could be other sub-systems under each of these systems. The choosing of the indicators in this approach is based on the sub-system's performance toward the Orientor and how sub-system contributes to the total system. System Orientors serve as a basic goal of each system and it guides individual systems towards the sustainability (Bossel, 1999). Similar to systems approach, Huang et al. (1998) presented a framework of indicator system for measuring urban sustainability of Taipei City. In this approach, a conceptual urban ecological economic system was drawn consisting of urban system at central with natural systems, agricultural systems, water resources systems, and imported resources providing it life-support services. Interestingly, stock and flow type of urban sustainability indicators are clearly distinguished (DPSIR framework is unable to account this). Indicators are obtained from bottom up approach with community participation for each identified system.

The choice of the framework by academicians is usually more complex and theoretically sound than the effort of the UN systems due to data availability, variation in the ground realities and several other factors. The choice of framework depends on the need and objective. Multi-level aggregation of the indicators usually lead to the loss of the original meaning and become too subjective, such index or indices are important in conveying powerful meaning for a complex problem. Aggregation may also lead to the loss

of information therefore valuation, weighing or scaling should be carried out very carefully, it needs sound basis for aggregating "oranges" and "apples" on common terms. In GDP, production cost is the common basis of aggregating economic activities. The utility of the product is not considered in GDP during valuation that could produce either positive or negative externalities. Further research is needed in the methodological aspects of the measuring sustainability and its progress.

Major debates in indicator initiatives

Indicator system development centers on many debates opening ways for future developments. Most of these debates are on top-down vs. bottom-up approach, context specific indicators vs. global common indicators, quantitative vs. qualitative indicators, and indicators measuring process vs. outcomes.

Top-down and bottom up approaches: Indicator initiatives described in detail in earlier sections are all top-down and experts-driven indicator systems. This raises several questions, are such approaches can capture the local specific features of the problems? Are they useful at all? Are experts imposing their values and ideas of sustainability to local communities, is it value neutral? People have argued that top-down approaches, mainly professional/bureaucratic dominance, are too weak to address local sustainability problems (Petersen, 1996; Stevenson and Burke, 1992). There is a sharp contrast in the way top-down experts think and that the ordinary citizens. Expert knowledge fails to consider many important things that ordinary citizens would consider important for creating sustainable cities (Wekerle, 1996). Stakeholder participation in indicator making process can help to alleviate the problem yet the expert dominance remains. The progress in the implementation of the Local Agenda 21 has provided additional impetus to context specific (local) indicator movement, and the rise of the community-driven approach.

Common vs different indicators: Many of the indicator initiative mentioned above cover a large number of cities and nations. Is there a universal set of indicators equally applicable to all those places? Economic, social, natural and political situation and priorities/values based on these situations vary considerably from place to place making an effective common set of indicators very difficult without lots of compromises. In urban context, developed countries may have interests in the notion of Eco-city, resources recycling based society, reducing consumption and changing lifestyle, while developing countries are struggling with sanitary and public health issues and reaching minimum level of calorie and protein intake to avoid malnutrition. How can we reach to a useful and realistic common set of indicators? Some of the initiatives have proposed a "core set of indicators" where core indicators are usually expert-driven and additional indicators are formulated with stakeholder participation. Maclaren (1996) cautions against the use of such core-indicators while the social, economical and political context are very much local in nature. Such approach is better but is fundamentally expert-biased.

Indicator characteristics: An ideal indicator is the one that meets several criteria such as analytically sound, policy responsive, quantifiable with existing reliable data, simple, open and flexible etc. In reality, all of the criteria are difficult to be met and data unavailability is a big problem. Simple vs. complex indicators is under considerable debate. Expert driven and academic indicators tend to be more complex while community-driven indicators are simple, although exceptions exist. Such debate can be seen in Brugman (1994), Peterson (1996) and Maclaren (1996). Burgman (1994) further argues on the value of sustainability indicators raising question, do we need them? He is critical of the energy and resources being given to make sustainability indicators in top-down approach. Considerable debate center on the quantitative vs. qualitative indicators. There is also some horizontal link between these controversies, for example, community-driven (bottom-up) initiatives usually favor the simple, qualitative indicators and context specific approach while top-down initiatives usually end up in complex (difficult to understand), quantitative (potentially inadequate) and common indicators (McMullan, 1997). Similarly, people promoting community-approach are NGOs, local authorities, international donor agencies and some of

the agencies of the UN system, while the promoter of the expert-driven approach are mostly national governments, academicians, research oriented institutions and agencies of UN system.

Bridging the gap on debates: lessons for future initiatives

All approaches are useful based on problem type: Despite of the debates on the approaches of the indicator development, there is considerable importance of each approach. Indicators can be constructed at multiple levels, such as global, national, local etc., and the applicability and relevance of each type of indicators is different. For making practical use of the expert-driven (top-down) indicators, a multiple layers of the consultation processes from the grass-root level are essential. As far as the stakeholder participation is ensured and indicators are not imposed upon the potential users any such indicator is useful provided it meets goal and useful to stakeholders. As for sustainability, current approaches are important but not sufficient and lots of future researches are necessary.

Dynamics and inter-dependency of indicators: The major objection in the existing indicator initiatives is the lack of accounting for the inter-indicator dependencies and dynamics. For example, in most of the countries, as economy progress the environment worsens (as a thumb-rule). In this case, indicators of economy have implications on the indicators of environment and vice versa. Such interactions and dynamic dependencies amongst the indicators over time are important in sustainability approaches. In the short term, economic overriding may be possible at the cost of environment up to a point before hitting the environmental irreversibility. This might be able to generate enough economic resources to clean up environment. Neglecting such dynamic relationships may lead to the long-term problems and force human society to embark into a difficult path of sustainability forgetting the easy path.

Linkage between indicators and policies: Although indicators are policy-based at many instances, policy-based indicators may fail in real sense due to lack of policy responsiveness of the indicators and non-enforcement of those indicators into the policies, targets, commitments and evaluations practically. This is true for many national as well as regional level initiatives. Disseminating information through indicators is a useful exercise, but "what next?" is an important question. For example, UNCHS has made Urban Indicators and City Development Index, but after the indicators are made most important question is how UNCHS or other stakeholders use those indicators. Such evaluation would be an important consideration. Once indicators are made, translation of those indicators into the policy making in a integrated way is the key. Pinfield (1996) points out that such evidence is little. Pinfield (1996) notes that the indicator driven integrated policymaking can counter the status quo and may run counter to culture and power structure of many governments. Especially in developing countries, where the decision-making and political commitment are not transparent, political leadership may hesitate to use indicator system in policy making as it has potential to show their inefficiency more visibly. In such case, realization of the indicators into the policy making would be difficult.

Process indicators are important: Apart from the outcome/evaluation type indicators, process indicators are also very important, particularly at local level in developing countries which lacks information on many of the successful policies and practices implemented elsewhere. Local authorities in developing have less-killed human resources, lack of technology and related information and know-how. Process indicator helps to transfers the knowledge or know-how and could be a combination of qualitative and quantitative indicators from one place to another. These essentially provide a menu of policy and actions to be implemented particular problems or goals. Such process indicators should be derived from the best practices implemented elsewhere with the required modification to suit the local specific conditions. Successful practices (or best practices) are difficult to define and there is no single standard for successful practices. Most of the successful practice database contains too little information on the process but put greater emphasis on the outcome. Also these is a little evidence on how such successful practice database were really useful to others. In reality, lessons can be learnt from both successful and failed programs.

Failed programs may also contain some of the best approached which worked for a particular problem but whole program itself was unsuccessful. So the important point in those process indicators is to extract the successful and replicable elements from existing programs and practices.

Multi-level indicators: Each nation and cities are different in terms of the economic situation, geography, culture, social values and national/local priorities. A single set of common indicators applicable to all the nations/cities is very difficult to find. In such circumstances, a scheme of multi-level indicators could be useful. Multi-level corresponds to either economic situation or time frame or both. The priority and relevance of the nations to a particular issue, described by the indicators, may depend on their economic condition. Therefore, multi-scale issues, based on economy and time frame, can be identified with few common universal issues. These universal issues are to be assumed independent of the local culture and values. Core-indicators can be built over those universal issues, and allow each nations/cities to add other issues and indicators over the core issues and indicators. Such added issues could be common based on the short-term or long-term priorities arising from the level of economic activities. OECD and EU based initiatives have used such approaches (OECD,1993; EU, 2000) but not sufficiently.

Unscientific use of indicators: Index or indices based indicator initiatives are constructed with several levels of aggregation. The meanings of such index or indices are to be interpreted carefully to avoid any confusion over their power to explain issue under consideration. It is very important to discourage the stakeholders or interest groups to convey wrong meaning from such index or indices. Indicators are not to be used *unscientifically*[1].

Conclusion

This paper has given a picture of the current trend of indicator initiatives. Salient features of selected international indicator initiatives and methodological aspects are discusses and analyzed. In the case of top-down type indicator systems aiming to measure progress towards sustainability or environment, over reliance on PSR (Pressure-State-Response) framework has been observed despite the fact that such framework has several limitations for integrated and complex issue such as sustainability and environment. Systems approaches are indeed important and also the analysis on the sustainability tradeoff in the short-term is lacking. Methodological improvements are indeed required.

Recently, local sustainability indicator construction by the local authorities or community-based organization has been very popular and this has given impetus to the bottom-up approach in contrast to the usual way of expert-driven top-down approach. We argue that each approach has its own merits and they need not to confront. A far as the local communities are concerned, they definitely have their own priorities and idea on what is meant by sustainability to them, however at the national level, many such local priorities are to be supported and activities are to designed. Therefore, participation of grass root level into any of such national indicator making and policy setting process is important and is the very essence of the decentralized democratic governance. Such participation can root out many of the debates of the indicators such as, simple vs complex indicators, common vs different indicators, performance vs outcome type indicators, etc.

Any place is different and unique and it is indeed difficult to have a common set of indicators equally applicable to all. Capturing a common set of core issue and expanding common indicators based on

[1] Unscientifically here means conveying wrong meanings. Such an unscientific use of indicator is seen for GDP. GDP has been portrayed as a well-being of the national at many instances, by various interest groups. This has contributed at some extent to over-emphasis on the economic growth priority with the notion that high GDP or GDP growth is the solution to all the human problems.

characteristics of the place is inevitable in any indicator making process. This again calls for a proper dialogue and participation of the stakeholders.

Lastly, the most important point is not making the indicator but how to use the indicators or information obtained from the indicators into the policy making. Little evidence is seen in that front. More efforts are required in translating the indicators into the policy making.

References:

Bell, S. and Morse, S. (2001) Breaking through the glass ceiling: Who really cares about sustainability indicators, **Local Environment**, 6(3), pp. 291-309.

Bossel (1999) **Indicators for Sustainable development: Theory, Methods, Applications**, International Institute for Sustainable development (Canada).

Brugman, J. (1994) **Sustainability Indicators: Do We Need Them?** International Council for Local Environmental Initiatives (Toronto).

Brugmann J. (1997) Is there a method in our measurement? The use of indicators in local sustainable development planning, **Local Environment**, 2(1), pp. 59-72.

Cobb C., Goodman G.S, and Wackernagel M. (1999), **Why Bigger isnot Better: The Genuine Progress Indicator**, 1999 Update, Redefining Progress.

EC (1997) **A European System of Environmental Pressure Indices**. European Commission, DG 34/F3, Eurostat/Environment Unit.

EU (2000) **Towards the Local Sustainability Profile: European Common Indicators**, Office for Official Publications of the European Communities, ISBN 92-828-9493-2, European Communities.

Forget, G, and Lebel, J. (2001) An Ecosystem approach to human health, **International Journal of Occupational Environmental Health**, 7(2).

Foxon, T; Leach, M.; Butler, D; Dawes, J; Hutchinson, D; Pearson, P. and Rose, D. (1999) Useful indicators of urban sustainability: Some methodological issues. **Local Environment**, 4(2), pp.137-149.

HDI (2000) **Human Development Report**, United Nations Development Program.

Huang S. L., Wong J.H. and Chen T.C. (1998) A framework of indicator system for measuring Taipei's urban sustainability, **Landscape and Urban Planning**, 42, pp. 15-27.

IUCN (1980) **World Conservation Strategies**, International Union for Nature Conservation.

Jesinghaus, J. (1999) **Indicators for Decision Making**, European Commission, JRC/ISIS/MIA, TP 361, I-21020 Ispra (VA) Italy.

Kline, E. (2000) Planning and creating eco-cities: indicators as a tool for shaping development and measuring progress. **Local Environment**, 5(3), pp. 343-350.

Levett, R. (1998) Footprinting: a great step forward, but tread carefully – A response to Mathis Wackernagel, **Local Environment**, 3(1), pp. 67-74.

Maclaren, V. (1996) **Developing Indicators of Urban Sustainability: A Focus on the Canadian Experience**, ICURR Press (Toronto).

Maclaren, V. (1996) Urban sustainability reporting, **Journal of American Planning Association**, Spring 1996, pp.184-202.

Manson Willms, Sharon and Leslie Gilbert (1991) **Healthy community indicators : lessons from the social indicator movement**, University of British Columbia, UBC Centre for Human Settlements (Vancouver).

McMullan, C. (1997), **Indicators of Urban Ecosystem Health**, Working Paper, Institute for Development Research Center (Canada).

Meadows, D. H. (1998) **Indicators and Information Systems for Sustainable Development**, A report submitted to Balaton Group, Hartland Four Corners: Sustainability Institute.

Moldan B., and Billharz, S (1996) **Sustainability Indicators: Report of the Project on Indicators of Sustainable Development**, John Wiley and Sons.

OECD (1993) **OECD Core Set of Indicators for Environmental Performance Reviews**, Organization for Economic Co-operation and Development (Paris).
OECD (1993) **OECD Core Set of Indicators for Environmental Performance Reviews: A Synthesis report by Group on the State of the Environment**, Organization of Economic Co-operation and Development (Paris).
OECD (1997) **OECD Environmental Performance Reviews: A Practical Introduction**, Organization of Economic Co-operation and Development (Paris).
OECD (2001) **Towards Sustainable Development: Environmental Indicators 2001**, Organization of Economic Co-operation and Development (Paris).
Petersen, A. (1996) The healthy city experience, and the regulation of space, **Heath and Space**, 2(3), pp. 157-165.
Pinfield, G. (1996) Beyond sustainability indicators, **Local Environment**, 1(2), pp.151-163.
SEPA (2000) **Urban environmental Management in China**, State Environmental Protection Administration, People's Republic of China, SEPA Publication.
Stevenson, H.M, and Burke (1992) Bureaucratic logic in new social movement clothing: the Limits of health promotion research in Canada, **Canadian Journal of Public Health**, 83 (suppl.1), pp. 47-53.
Takano, T; Nakamura, K. (2001) An analysis of health levels and various indicators of urban environments for Healthy Cities projects, **Journal of Epidemiology and Community Health**, 55 (4), pp. 263-270.
UNCHS (1997) **Monitoring Human Settlement with Urban Indicators**, United Nations Center for Human Settlement (HABITAT).
UNCSD (2001) **Report of the Aggregation of Indicators of Sustainable Development**, Background Paper for Ninth Session of the Commission of Sustainable Development, United Nations.
UNCSD (2001) **Information for Decision Making and Participation: Report of the Secretary General**, Commission on Sustainable Development, Ninth Session, April 16-17.
Wackernagel, M. and Rees, W (1997) **Our Ecological Footprint: Reducing Human Impact on the Earth**, New Society Publishers (Canada).
Waddell, S. (1995) Lessons from the Healthy Cities Movement for social indicator development, **Social Indicators Research**, 34, pp. 213-235.
WB (1999) **Environmental Performance Indicators, A Second Edition Note**, Lisa Segnestam, Paper No. 71, Environmental Economics Series, The World Bank.
WB (2001) **World Development Indicators 2001**, CD – ROM and Paper Version, World Bank Publication.
WCED (1987) **Our Common Future**, The Report of World Commission on Environment and Development, Oxford University Press.
WEF (2001) **2001 Environmental Sustainability Index**, World Economic Forum, Annual Meeting 2001, Davos, Switzerland.
Wekerle, G. R. (1996) Reframing urban sustainability: Women's movement organization and local states, in **Local Places in the Age of the Global City** (Edited by Keil, R, and Wekerle, G.R.), Black Rose Books (Toronto).
WHO (1997) **Healthy Cities Indicators: Analysis of data from cities across Europe**, WHO Regional Office for Europe (Copenhagen).
WWF (2000) **Living Planet Report 2000**, WorldWide Fund for Nature Conservation.

Indicator Research - part II

Preliminary framework and list of Indicators for Assessment of Urban Environmental Sustainability

Conceptual framework of IGES Urban Environmental Sustainability Indicators

By nature, a city cannot be sustainable on its own because city extracts resources from surrounding rural areas and import of the resources to meet the demand of goods and services in the city. Cities are one of the root causes of the sustainability problem and are therefore a key to promote sustainability (Rees and Kenworthy).

Our definition of urban environmental sustainability is adapted from Brundtland Commission's definition of sustainable development (WCSD, 1987). Brundtland Commission definition is: *"Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs".* The idea of the limitations imposed in above definition is mainly on the environment's ability to meet the demands. We modify this notion slightly to make it applicable to the urban context. We also specify few concrete elements in the definition for making it *a working definition*.

In our definition, the path of urban environmental sustainability is the one in which urban development meets the environmental needs of the present urban dwellers without compromising the ability of non urban dwellers and the future generations to meet their own needs which are affected by the environment. The idea of the limitation imposed by the definition is (1) the impacts of the city on the environment of the city (2) resources inputs to the city from hinterlands and outside of the city, and (3) outflows from the city. Such impacts may compromise the ability of the urban dwellers, non-urban dwellers and future generations to meet their own demands.

Sophisticated analysis on urban environmental sustainability is possible with the help of the rigorous urban sustainability framework. Many such analyses are reported in academic arena and at city specific context. However, in our study we wish to formulate an indicator system that is as simple as possible, flexible and understandable by policy makers in cities. Our indicator system is policy oriented with the aim that it would be able to assist policymakers to integrate the notion of environmental sustainability more concretely in all aspects of the urban policies and planning.

Our approach of framing up of the issues surrounding urban environmental sustainability has roots in the PSR (Pressure State Response) framework that has been widely used in sustainability and environmental assessments. Traditional PSR framework does not explicitly include the vulnerability of human systems to cope with the changes in the environmental systems. Our approach recognizes the need to include exposure and vulnerability concepts for urban analysis. In this aspect, it is similar to Environmental Sustainability Index (ESI) of World Economic Forum. We are deviated slightly from the PSR as well as ESI approach for making it more relevant for cities. Although PSR framework is based on the idea of isolating and tracking chains of causes and effects, we do not isolate causes and effects explicitly and we use this framework more in the fashion of *system's approach*.

Our definition of urban environmental sustainability has four essential *elements* as shown in figure 1. This approach believes that the environmental sustainability at city level can be achieved by (1) maintaining environmental systems at a healthy level (2) reducing the pressures on environmental systems (3) reducing the socio-economic and human vulnerability from the changes in the environmental systems, and (4) improving the response capacity to the changes in environmental systems, to the stress on environmental systems and to cope with vulnerability.

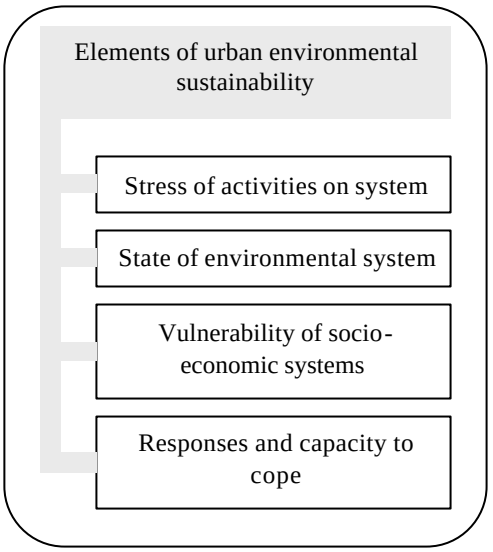


Figure 1. Urban environmental sustainability

The sustainability *determinants* for each of these essential elements are identified in Table 1. Major determinants are selected based on the basic needs of urban dwellers that are explicitly related to environment. These determinants are also common to all cities regardless of the differences in city attributes, such as socio-economics, geography, climate etc. These were obtained from a careful review of past literatures, expert judgement and our discussion with various experts who are knowledgeable in this area. However, we still believe that there are rooms for further improvement in the selection of determinants and we will do so continuously. These are indeed a preliminary set of determinants.

Table 1. Determinants of urban environmental sustainability

Elements	Determinants
Maintaining environmental systems	Air quality
	Water availability
	Water quality
	Urban green
Reducing environmental pressures	Reducing pressure to air quality
	Reducing pressure to water systems
	Reducing waste
	Reducing pressure of consumption
	Reducing demographic pressures
Reducing vulnerability	Availability of basic human needs
	Human health facilities
Improving response strategies	Institutional capacity
	Economic and financial capacity
	Efficient energy use

Selection of indicators

The choice of indicators for each sustainability determinant is made on the basis of a careful consideration to their power to explain sustainability determinants. The availability of data at city level is lower and policy makers who potentially use these indicators usually prefer simple and easily understandable indicators. Therefore, data available, simple, easily understandable and flexible indicators are chosen as far as possible while maintaining the other characteristics such as analytically sound and scientifically valid.

Air quality: The contribution of different air pollutants in a city varies depending on the economic structure, geography, meteorological conditions, and energy use among others. Industrial cities are usually confronted with regional pollutants such as sulfur dioxide and local pollutants such as particulate matters. Non-industrial cities in the developing countries suffer from dust and transport borne pollutants such as particulate matters. Similarly, controlling NO_2 emissions remains a big problem in cities of the developed countries such as Japan. Type of energy use in household sector also determines SO_2 emissions. High SO_2 concentration has sustainability implications through acid rain and related desertification problems. Particulate matters pose serious threat to urban dwellers in the form of an immediate health problems. CO2 concentration, however, is a global phenomenon and is considered in terms of its annual emissions as a factor to cause environmental stress. Therefore, SO_2 and TSP concentrations are selected as prospective indicators of air quality.

Water availability: Water availability is a short-term as well as a long-term concern for environmental sustainability. In short-term, the inadequate supply of clean water for urban dwellers has health implications. If the present water renewable rate exceeds the water extraction rate (fresh water deficits), then it is a serious threat to environmental sustainability in a long-term. Therefore, indicators are chosen to address these issues specifically, and those are; per capita water availability and water renewable rate of the water sources that are supplying water to the city.

Water quality: Effluents from factories and public sewerage systems are responsible for polluting water bodies such as the rivers, lakes, canals and bay area (coastal area) that are within the perimeter of a city. Water quality is responsible for public health problems as well as the loss of aquatic/marine plants and animals. The indicators chosen are therefore; average BOD (or DO) concentration of major water bodies and average COD concentration of coastal water.

Urban green: The role of green space in urban system is very important and is identified as one of the determinant of urban environmental sustainability. The availability of the green area in the city is chosen as one of the indicators. However, we note that this does not explain the spatial aspects of the green area such as how green areas are distributed among population and how many citizens have access to those green areas. Such limitation is primarily due to data availability considerations.

Reducing pressure to air quality: The emissions of pollutants are single most important factor for pollutant concentration, which are relatively worse in densely built-up area as compared to others. For local pollutants such as TSP and VOCs, their emission volume in the built up area is of significant concern while SO_2 has effects at regional level. Therefore, selected indicators are; SO_2 emissions per unit of city area, TSP emissions per unit of built up area and VOCs emissions per unit of built up area. Apart from emissions themselves, the activities that produce these emissions are also addressed such as coal consumption per unit built-up area, number of vehicles per unit paved road length, and the share of mass transportation in travel mode.

Reducing pressure to water system: Volume of water uses and the abstraction of ground water in unsustainable way are the major factors that put pressure on the water supply system and resources. At the discharge side, volume of the wastewater discharge are identified as a single most factor. Therefore, the choices of the indicators are: water use per capita, share of ground water in total water supply, volume of municipalwastewater discharges per capita, and volume of industrial wastewater discharges.

Reducing waste: Solid waste remains to be one of the major problems in the big cities due to the unavailability of the space or capacity of the incinerators. High per capita waste put pressure on waste management, waste treatment and related environmental adversities. Therefore, waste per capita is chosen as one of the indicators.

Reducing pressure of consumption: The consumption of goods and services in the city exert pressure on the outside of the city boundary. This includes implications to the hinterlands as well as other places for producing those goods and services. Ecological footprint of the city per capita is selected as an indicator for accounting such consumption pressures. Ecological footprint is a measure of the disparity between resource consumption and city's natural carrying capacity.

Reducing demographic pressures: The density of the settlements, which is a root cause of demographic pressure is often a controversial issue. Some researchers argue that a compact city reduces the resources use per capita, and therefore promote cities towards sustainability. However, in our understanding, population growth in the city is the root cause of the urban sustainability problem. Therefore, population density of the built up area is chosen as indicator.

Availability of basic human needs: Clean water, availability of sewerage system and availability of solid waste management system are considered to be basic human needs. Therefore, the chosen indicators are: % of population with access to tapped water, % of water demand met with tapped water, % of population with access to sewerage system, and % of total solid waste collected.

Human health: Number of doctors per 1000 population, number of hospital beds per 1000 population.

Institutional capacity: Number of staffs dealing only with environment in city government per 100,000 population, % of industries complied with emissions control regulations, % of vehicles complied to emissions control regulations. This addresses institutional failures to enforce the regulations.
Economic and financial capacity: % of budget of local government allocated for environment, per capita gross city product
Efficient energy use: Share of renewable energy in total energy use, CO_2 per capita of energy use

Table 2. List of indicators

Sustainability determinants	Indicators
Air quality	SO_2 concentration
	TSP concentration
Water availability	% of population with access to adequate and clean water
	Water renewable rate of the source
Water quality	BOD concentration of inland water bodies
	COD concentration of coastal water
Urban green	% of green area in the total land use
Reducing pressure to air quality	SO_2 emissions per unit of city area
	TSP emissions per unit of built up area
	VOCs emissions per unit of built up area
	Coal consumption per unit built-up area
	Number of vehicles per unit paved road length
	Number of cars per 1000 population
	Share of mass transportation in travel mode
Reducing pressure to water system	Water use per capita
	Share of ground water in total water supply
	Volume of municipal wastewater discharges per capita
	Volume of industrial wastewater discharges
	Annual BOD discharges
	Annual COD discharges
Reducing waste	Per capita waste generation
Reducing consumption pressure	Ecological footprint

Reducing demographic pressure	Population density of built up area
Availability of basic human needs	% of population with access to tapped water
	% of water demand met with tapped water
	% of population with access to sewerage system
	% of total solid waste collected
Human health	Number of doctors per 1000 population
	Number of hospital beds per 1000 population
	Child mortality
Institutional capacity	Number of environment staffs in city government per 100 thousand population
	% of industries complied with emission control regulations
	% of vehicles complied to emission control regulations
Economic and social capacity	% of budget of local government allocated for environment
	Gross city product per capita
	Adult literacy rate
	Household below poverty line
Efficient energy use	Share of renewable energy in total energy use
	CO_2 per capita from energy use

Indicator Research - Part III

Preliminary study for assessing the prospects of designing indicator system for Kitakyushu Initiative

1. Background

The importance of indicators for urban environmental management was expressed by Kitakyushu Initiative for a Clean Environment (hereafter, Kitakyushu Initiative). Kitakyushu Initiative was endorsed by Ministerial Conference on Environment and Development (MCED) held in the city of Kitakyushu from 31 August - 5 September 2000.

The main focus of the initiative is to improve the urban environment, in that, it is intended to set the quantitative targets in few action areas and efforts would be made to implant the policy and actions to achieve those set quantitative targets. The indicators are intended to set the targets and to measure the effectiveness or success of the policies to enable periodic review and adjustment. The ultimate scope of the indicators is not limited to the local level only. The basic idea is that the indicators would first be measured at the local level in selected action areas and then expanded to all action areas and finally aggregated for the national and regional level. For this, the detailed measurement and aggregation procedures will have to be further defined through continuous consultations in the future. At this instant, the local indicators with global significance are of focus.

This indicator system is the result of the very first effort to understand the characteristics of the indicators and the framework for prospects of designing the indicator system for urban environmental management in selected policy fields to be applied to the cities of Asia-Pacific. Most of the past indicators have focussed either at sustainability in general or policy at national level. Application to such indicators for local level has serious problems due to data availability and lack of focus on urban-specific issues. Indicators with local scope such as Urban Indicators of HABITAT focus on shelter and human settlement related issues. European Union's Local Sustainability Indicators have different focus that has difficulties to be applied to the cities of the developing countries that most of Asia-Pacific cities belong to. Some of the national initiatives on indicators such as the one by Chinese (PRC) government is to provide the ratings of cities in terms of environmental performance. Most of the past indicators are designed to provide the rating of the cities in terms of environmental performance rather than specific policy actions.

In this paper, many existing indicator systems are studies in detail. These are mainly,

- City Development Index by UN/HABITAT [1]
- Indicators of Sustainable Development by UN Commission on Sustainable Development [2]
- Environmental Sustainability Index by World Economic Forum [3]
- Policy Performance Index by European Commission [4]
- EU Local sustainability Indicators [5]
- Urban Environmental Quality Examination System by Chinese (PRC) Government [6]
- Core Set of Indicators by OECD [7]

The following indicator systems are also paid attention as reference materials

- The ecological footprint by Mathis Wackernagel and William Rees [8]
- Genuine progress indicator and index of sustainable economic welfare by Redefining Progress [9]
- Living planet index by World Wide Fund for Nature International [10]

- Human development report indices by UNDP [11]
- Well-being assessment by IUCN [12]

2. Review of the Past Indicator Systems and its implication to Kitakyushu Initiative

This section contains the results of the preliminary studies on past indicator systems. Details are attached as an appendix to this paper.

Most of the past indicator systems followed Pressure-State-Response (PSR) framework or some others derived from it such as Driving force- State- Response (DSR) or Driving force-Pressure-State-Impact-response (DPSIR). Urban Indicator of HABITAT used the framework of project cycle, and designed indicators for selected policy packages under HABITAT agenda. UNCSD followed chapters of AGENDA 21. Amongst the studied indicator systems, only one, i.e. Environmental Sustainability Index by world Economic Forum, attempted to include the human vulnerability and the environmental impacts into the indicator system. All the indicator systems analyzed here attempted to integrate the overall environmental conditions and general policy responses into the indicator system.

Some of the indicator systems aimed to construct a single indicator or an index while others relied on group of indicators. The aggregation techniques employed in constructing an index were unique in terms of weighting and valuation. Most of the indices were quantitative except a European Commission initiative that relied on the color codes to construct Policy Performance Index. It was noted that a multi-level aggregation of the indicators might lead to the loss of the original meaning and become too subjective.

However, the analyses carried out in this study provide a good reference for constructing an indicator system for Kitakyushu Initiative. It may help to identify the major issues, priority area, and methodology for Kitakyushu Initiative.

Ideally, an environmental indicator should be simple to understand by stakeholders, measurable with available data, policy relevant, policy responsive and analytically sound. For use in the international arena, they have to be cross-country comparable. However, it is not always easy to get the indicators meeting all these criteria. The indicator system to be developed should not only address environmental conditions but also be able to address comprehensive policy packages with enough indications to policy responses and driving forces.

The type of priorities and responses needed in developing Asian cities might be different from European and developed cities. The indicator system should consider this reality seriously. The selection of suitable issues and theme should be carried out. For example, European Local Sustainability Indicators, which are being tested in more than 90 cities in Europe, has addressed the issues that are not very relevant at this stage to the cities in Asia-Pacific.

The availability of the local/city specific data might be a big problem for setting indicators in developing Asian countries. In this connection, two-step approach might be useful where a core set of indicators would be developed first with the minimum amount of data requirement and later expand to a comprehensive set of indicators.

Strictly quantitative indicators have several weaknesses in knowing the environmental situation. The indicator somehow should addresses both qualitative and quantitative features. A set of indicators, instead of a single index is proposed.

Only HABITAT Urban Indicators have been used to address specific policy packages, all other indicators try to evaluate overall city or nations in terms of their environment and environmental policy performances. Kitakyushu Initiative should learn from the experiences of HABITAT.

3. Distinguish Features of Kitakyushu Initiative Indicator System

The main objective of the most of the past indicators analyzed is to provide an indication on the overall performance of the city or a nation in terms of its environment or its environmental policies. However, the scope of those indicators is not limited to demonstrate the state of environment but they also provide indications on how well the city's various activities that affect its environment (driving forces to worsen the environment) are progressing and how well the response measures taken by the government and non-governmental sectors are progressing. At the same time, the indicators provide an evaluation of the response measures. In designing the indicators for Kitakyushu Initiative, it is recognized that the above objectives are not enough for cities of the Asia-Pacific. The system should somehow provide assistance to the cities in disseminating various kinds of possible response measures and an idea on what could be the best way of designing and implementing a specific policy based on the analysis of the successful policies implemented elsewhere. The indicators system should also assess the performance of the specific environmental policies in selected action areas.

4. Methodological Framework

Scope: A city, a metropolitan area or a municipality (at the moment)

4.1 Potential Functions of Indicators in Kitakyushu Initiative

- Indicate the state of environment or environmental pressures for setting targets of selected policy packages: *Target indicators*
- Measure and monitor the progress of response measures of selected policy packages: *Action Indicators*
- Assess the performance of selected environmental policy packages: *Performance Indicators*

The indicators would be suggested to apply to all the member of Kitakyushu Initiative Network. The testing of the indicators should be carried out in the pilot project cities in selected environmental policy fields such as air, water etc. The testing is expected to assess and to fine-tune the indicators and help to further extend the indicator system.

4.2 Criteria of Quantitative Indicator Selection

The quantitative indicators should be used in target setting and in measuring the progress of selected policy packages. A combination of quantitative/qualitative indicators and best practice analysis would be useful in designing/implementing policies and in assessing the performance of the policy packages.

The quantitative indicators should be:

- Local in scope
- Explicitly or implicitly related to environment
- Relevant to policy
- Simple and measurable with existing reliable data
- Responsive to policy
- Analytically sound

The qualitative indicators should:

- Be measurable in quantity, as far a possible
- Come from analysis of best practices

4.3 Prospective Methodology of Indicator System

DPSIR (Driving force, Pressure, State, Impact, Response), DSR, PSRI or PSR frameworks have been widely applied in the past to present the indicators related to the sustainable development. This framework traces the specific chains of cause and effect for a particular environmental problem [13]. This framework has been criticized for its failure to address many feedback loops and neglecting the systematic and dynamic nature of the processes. Interconnected nature of the problem indeed makes it difficult to describe the impact by isolated chains. Yet, this framework has been popular and is most systematic and therefore DPSR framework would be a useful launching pad.

In this study, Driving-forces are omitted from DSPR framework, and instead, they are integrated into the responses. State or pressure indicators are used to set the target. Various response measures are identified to meet the target. A qualitative set of factors would be derived from the best practice analysis of similar policies implemented elsewhere that provide assistance in designing the policies. Other quantitative indicators measure the progress of the response measures.

The segregation of theme can be done in a variety of methods. Some of these are:

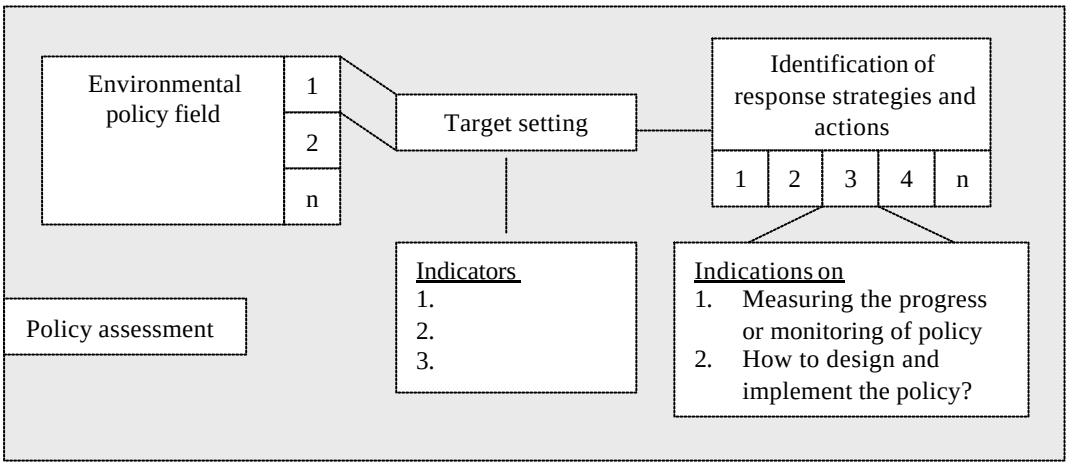
- Cause-effect based: Driving force-Pressure-State-Impact-Response
- Physical phenomenon based: Land, Air, Water etc.
- Broad based: Citizen satisfaction, local mobility, outdoor air quality, local participation etc.
- Sector based: Transport, household, commercial, industrial, energy etc.
- Policy fields based: Climate change, air pollution, water pollution, solid waste, urban green etc.
- Action based: environmental quality, pollution control, environmental infrastructure development, environmental management

Kitakyushu Initiative wishes to apply the indicator to the specific environmental policy area. For this reason, the classification of the themes could be done on the basis of environmental policy fields. It is recognized that there would be many important indicators that belong to the general state of the city or that do not belong to any of the environmental policy fields explicitly or that are common to all of the environmental policy fields. To address such indicators, a separate category can be created, such that,

I. Specific environmental fields:
   a) Air pollution
   b) Water pollution
   c) Solid waste
   d) Noise pollution
   e) Open space and urban green

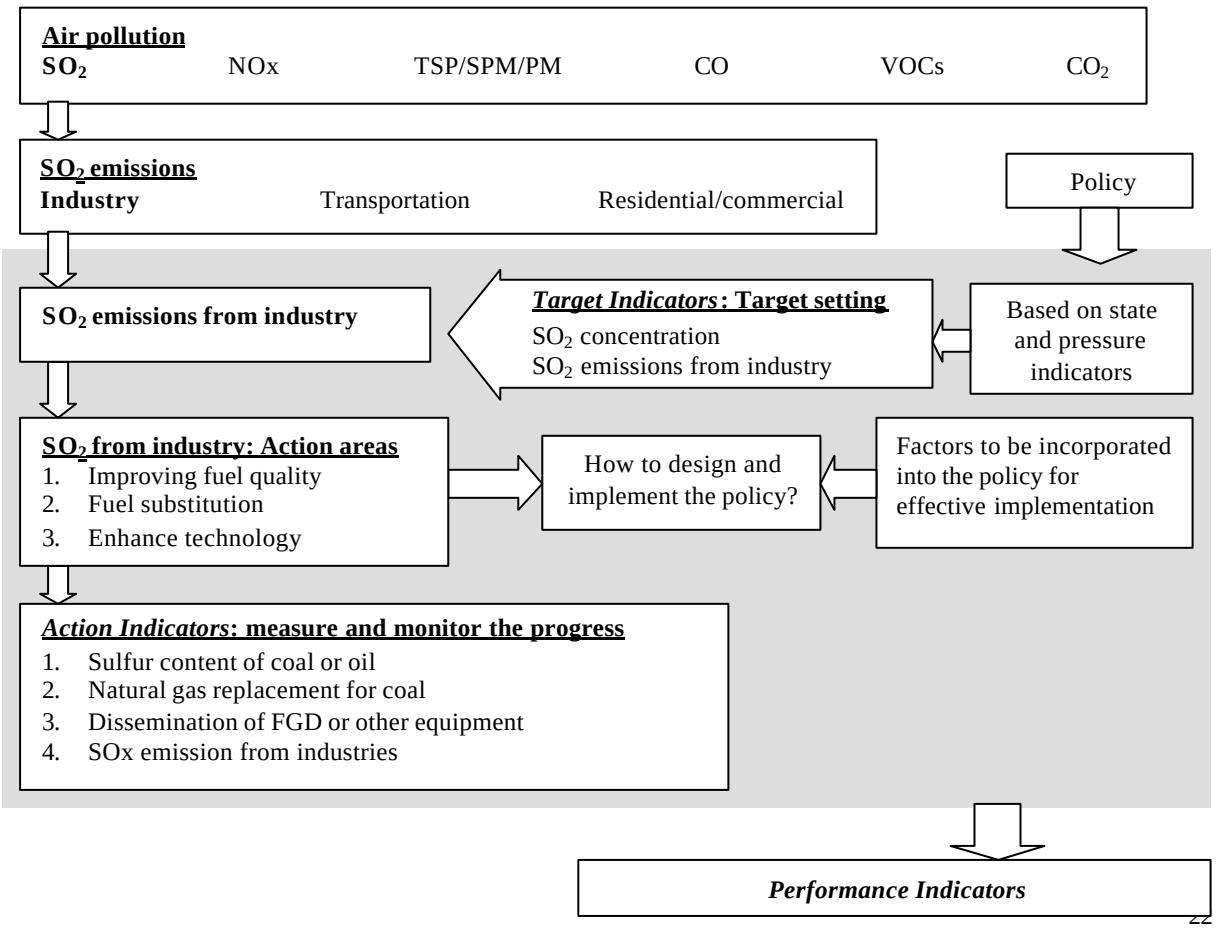
II. Holistic indicators
   a) Institution related
   b) Integrated policies/strategies

The prospective framework is depicted in the figure below,



4.4 An Example of Methodology: Flow chart

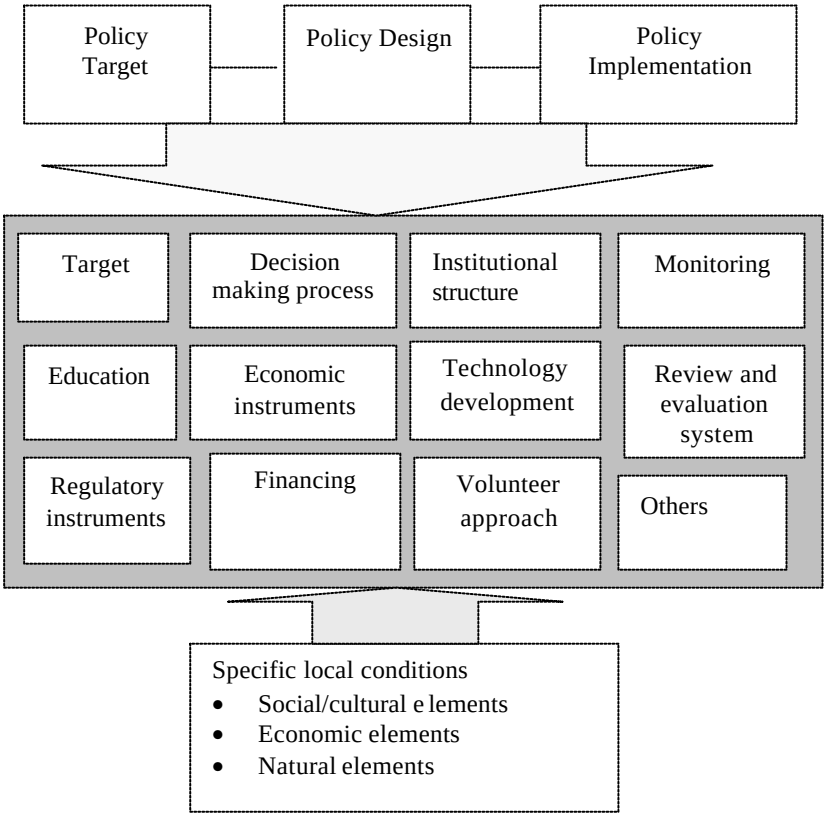
The sectoral scope of the environmental policy fields would be economic sectors, namely, industry, transportation, residential/commercial and energy sectors. An example on the SO_2 emissions is illustrated in the below figure.



4.5 Best Practice Analysis

The best practices (successful policies) of urban environmental management in many action areas would be collected from the network members of Kitakyushu Initiative. Analyses on selected action area's best practices would be done to identify the essential factors or elements in the policy. The objective of the analysis would be

- to analyze the various elements incorporated into the policy/program
- develop qualitative indicators for action areas



Above framework would assist also in defining best practices in urban environmental management and gives insight on the required elements for the replicability of best practices to other cities in Asia Pacific. The framework would assist members of the Kitakyushu Initiative Network to establish the policies and actions while learning from experiences of other cities in the region.

4.6 Indicators for the Assessment of the Policy Package (Performance Assessments)

An assessment for the performance of the urban environmental policies would be carried out in the future. The detail framework and scope of these indicators would be set after consultations and discussions with different stakeholders of Kitakyushu Initiative.

Tentative performance criterions are listed below. This should be subject of the further research.

Box:1

1. Effectiveness : Effectiveness of target, Achievement of target, Source reduction or problem shifting
2. Economic efficiency: Employment, investment, cost benefit analysis etc.
3. Resources efficiency: Resources minimization
4. Equity: Distributional effect
5. Impact on other sectors: Social and economic impacts, integrated issues, Social acceptability
6. Partnership and participation of stakeholders
7. Pioneering spirit : Transferability, Pioneering model
8. Lesson learned

5. Conclusions and Outstanding Issues

The review of the past indicator systems provided a better insights on the indicator system that would be of interest to the Kitakyushu Initiative. This helped in understanding the scope of the issues, possible approaches, potential area of indicator use and possible hurdles.

Undoubtedly, data would be the biggest hindrance in such indicator system of local context. A large number of indicators are difficult to realize in reality due to data problems. Few simple but powerful indicators are required. Before fine-tuning the list of action areas and indicators, few outstanding issues should be cleared.

A. Scope of the indicators:

Expectation from indicators: Where and how we utilize the indicators, narrowing down is required

(1) To assess the state of environment of a city
(2) To evaluate a city or evaluate the progress of a city in terms of its environmental policies
(3) To be applied for a selected policy action areas of selected environmental policies. This means that the indicators deal with a policy package. The indicators should be able to provide basis for setting the target, give indication on how to design the policy, how to implement the policy and assess the policy for its performance

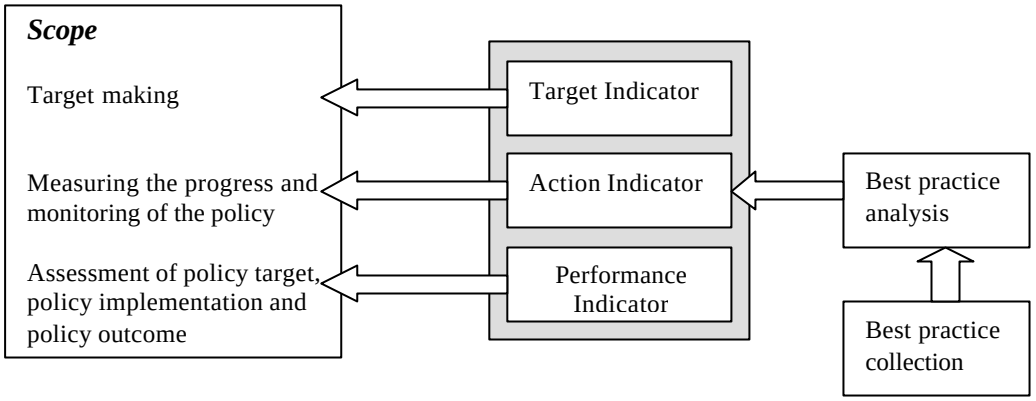
If the indicators is for selected policy packages, the scope (environmental fields, depth of policy, macro-micro level policy) of the policy packages should be fixed. The level at which policy statements are to be made should be ascertained. There could be many action areas, therefore, the types of action areas need to be fixed.

B. Number of indicators and data problem

The number and types of the realistic indicators should be fixed tentatively. The review of the past indicator system show that it is difficult to get data even at a national scale. Local authorities may have problem in terms of human resources and technical know-how. Data simply may not exist for local cities. The contentious issues could be how to motivate cities to present their best practices and information since we cannot have pilot projects at all member cities.

C. Replication of best practice

How to use best practice analysis into the replication in the field realistically?



6. References

[1] HABITAT(1997), Monitoring Human Settlements with Urban Indicators, United Nations Center for Human Settlements, Nairobi, Kenya, available at http://www.undp.org/un/habitat/
[2] UNCSD (2001), Indicators of Sustainable Development, United Nations Commissions on Sustainable Development, available at http://www.un.org/esa/sustdev/isd.htm
[3] WEF (2000), Pilot Environmental sustainability Index, An Initiative of the Global Leaders for Tomorrow Environment Task Force, world Economic Forum, annual Meeting 2000, Davos, Switzerland, available at http://www.ciesin.org/indicators/ESI/pilot_esi.html
[4] EC (2001), A European system of Environmental Pressure Indices, European Commission, available at http://esl.jrc.it/envind/theory/handb_.htm
[5] EC (2001), European Common Indicators for Local sustainability, available at http://www.sustainable-cities.org/indicators/
[6] SEPA (2000), Urban Environmental Management in China, Published by State Environmental Planning Administration, People's Republic of China (PRC)
[7] OECD (1993), OECD Core set of Indicators for Environmental Performance Reviews, Organization for Economic Cooperation and Development, Paris, available at http://www.oecd.org/env/indicators/publications.htm
[8] Mathis Wackernagel and William Rees, Our Ecological Footprint: Reducing Human Impact on the Earth, available at http://www.newsociety.com/oeffs.html
[9] RP (1998), Genuine Progress Indicator, Redefining Progress, available at http://www.rprogress.org/pubs/gpi1999/gpi1999.html/
[10] WWF (1998), Living Planet Report 1998, World Wide Fund for Nature International, available at http://www.panda.org/livingplanet/lpr/index.htm
[11] UNDP (2000), The 2000 Human Development Report, United National development Program, available at http://www.undp.org/hdro/99.htm
[12] IUCN (1999he Well-being of Nations: a country by country index of quality of life and the environment, IUCN-The World Conservation Union, available at http://iucn.org/themes/eval/english/samwon.htm
[13] Bossel Hartmut (1999), Indicators for Sustainable development: Theory, Methods, Applications, International Institute for Sustainable development (IISD).

APPENDIX A

Review of Existing Indicator Systems

1. Introduction

Indicators are the powerful tools that can perform variety of the tasks. Merriam-Webster's dictionary defined "Indictor" as the 'one that indicates'. The obvious question is 'what it indicates'? In the context of the economy, the same dictionary defines indicator as 'any of a group of statistical values that taken together give an indication of the health of the economy'. However, an indicator not necessarily has to be statistical or quantitative, it could be of qualitative nature too. OECD has defined indicators as a parameter or a value derived from parameters, which provides information about a phenomenon. In that sense, indicators reduce the number of measurements and parameters, and try to provide "exact" representation of a situation [1]. The choice of a group of indicators or a single indicator depends on variety of factors and requirement. In general, accuracy of a single composite indicator depends on weighting techniques, and the level of aggregation among others. Urban Indicator Program of UN/HABITAT defined it as "Indicators are not data, rather they are models which simplify a complex subject to a few numbers that are easy to grasp and to understand by policy makers" [2]. Gross domestic product (GDP), Human Development Index (HDI) and several other singles but powerful indicators exist today that play very important role in the development process.

In the context of the environmental policy, planning, and management, the usual task of the indicators is to keep track of environmental progress and to give feedback to the policy makers for appropriate policy undertakings. These policy undertaking will have to take place in the economic and sectoral policies, therefore the indicators should ensure the integration of the environmental concerns into those policy arena. Thirdly, quiet often indicators are used to evaluate the environmental performances and policy outcomes. More recently, indicators have been widely used to keep track of the progress towards sustainability that is closely linked to the environment.

The objective of this study is to review the existing indicator systems that are in use or proposed by various organizations, their approaches and methodologies. This would help in designing and recommending new indicator system to be used in Kitakyushu Initiative for a Clean Environment (hereafter, Kitakyushu Initiative).

Kitakyushu Initiative was endorsed at 4th Ministerial Conference on Environment and Development (MCED) held from 31st August to 5th September 2000 in Kitakyushu City, Japan. In the implementation of Kitakyushu Initiative, it was decided to monitor the improvement in urban environment by quantitative indicators. Institute for Global Environmental Strategies (IGES) is entrusted to identify the practical indicators and to design the indicator system for Kitakyushu Initiative. These indicators would help in preparing and implementing integrated and sustainable urban environmental strategies by local authorities in Asia-Pacific.

The scope of the Kitakyushu Initiative indicators is local in nature. Indicators at local level that are related to the urban environment are of focus. The indicators are envisioned to be applied for target setting and to measure the progress and to evaluate the performance of the policy packages.

2. Scope of this Study

A wide range of the indicators is in use throughout the world. Each indicator system has its own peculiar need and therefore own approach and methodology. International Institute of Sustainable Development (IISD) has developed a Compendium of Sustainable Development Indicator Initiatives that contains links to various such indicator initiatives (http://iisd.ca/measure/ compindex.asp). Similarly, a useful list of development indicators is hosted by Institute of Development Studies, Sussex (http://www.ids.ac.uk/eldis/hot/indicator.htm).

Most of these indicators address either global or national issues. Only few, such as Urban Indicator Program of UN/HABITAT, Chinese nation government's urban environmental assessment program, and few others address environmental issues at local level. That does not mean that national scale indicators are not useful to Kitakyushu Initiative since study of the those national indicator systems could help to create a sound basis for designing and selecting indicator and in setting approach and methodology for Kitakyushu Initiative Indicators.

Since the scope of this study is to outline the currently available approaches useful to Kitakyushu Initiative, few potential and useful indicators are considered here. These are:

- City Development Index by UN/HABITAT
- Indicators of Sustainable Development by UN Commission on Sustainable Development
- Environmental Sustainability Index by World Economic Forum
- Policy Performance Index by European Commission
- EU Local sustainability Indicators
- Urban Environmental Quality Examination System by Chinese (PRC) Government
- Core Set of Indicators of Organization by Economic Co-operation and Development

3. Methodological Framework to Review Indicator Systems

The following structure is followed while analyzing indicators. For each indicators selective issues are studies. These are:

- Organization, Title, Brief Description (scope, type of issue addressed, methodology, distinctive features), relevancy for Kitakyushu Initiative

4. Indicator System Studied

4.1 City Development Index (CDI)

Organization: United Nations Center for Human Settlements (HABITAT)

Title: Urban Indicators Program

Source: http://www.undp.org/un/habitat/guo/uip.htm

Brief Description:

The CDI addresses the whole urban area but since this initiative is the offshoot of the housing and shelter indicators, the emphasis is given to the urban settlement related issues. 40 indicators are identified under six themes, i.e. socioeconomic development, infrastructure, transport, environmental management, local government and housing. From these 40 indicators, five indices are constructed, namely, infrastructure

index, waste index, health index, education index and city product index. The CDI is composed of these five indices. The methodology of CDI development revolves around the Policy Development Cycle.

The indicators in infrastructure theme are household connection level, access to potable water, consumption of the water, and price of water. Transport theme contains, modal split, travel time, road infrastructure expenditure and automobile ownership. Environmental management theme contains wastewater treated, solid waste generated, solid waste disposal method, regular solid waste collection and housing destroyed.

The overall set-up of the indicator system is impressive. For all HABITAT policy agenda, one or more indicators are selected from the existing pool of indicators. These indicators along with few additional qualitative indicators address different policy packages to serve as a means of implementing the HABITAT agenda. For e.g. for each policy statement, actions and indicators (quantitative plus qualitative) are clearly assigned.

The method to construct a CDI is similar to Human Development Index (HDI) of United Nations Development Program (UNDP). In CDI, infrastructure index is constructed by percentage of households connected to services (water, sewerage, telephone, and electricity) and percentage of households with access to potable water. Waste index is formed by percentage of wastewater treated and solid waste disposal method. Health index considers child mortality and hospital bed. Education index use primary and secondary classrooms and city product includes city product per person. This is cross-country comparable.

Relevancy to Kitakyushu Initiative:

City Development Index (CDI) is the most comprehensive and systematically formulated indicator system typically targeted to the cities. Detail indicators are made for the local government's situation. Several of the chosen indicators have direct and indirect linkage with the environment. But in general, environment related indicators are very few and are limited to solid waste and wastewater. Policy responses to improve environment are not adequately represented by the indicators. Issues like hazardous and toxic wastes, recycling and reuse are ignored and most importantly, the indicators do not touch upon air quality, climate change and related policy responses. Without the sufficient indicators that illustrate the state of the environment, effectiveness of the environmental policy measures is difficult to evaluate from these indicators.

Although not reflected in CDI, Urban Indicator Program of UN/HABITAT has outlined an extensive list of indicators (about 124) that covers environment in a better way (refer to Monitoring Human Settlements-Abridge Survey, http://www.undp.org/un/habitat/guo/uip.htm).

Urban Indicator Program of HABITAT has also outlined an action oriented indicator system, which could provide a good basis for the indicator system for Kitakyushu Initiative. In this, policy statements are set based on HABITAT agenda, specific actions are identified, and quantitative and qualitative indicators are constructed for the specific action areas. However, this does not give detail accounts on how to design and implement the actions and policy.

4.2 Indicators of Sustainable Development

Organization: UN Commission on Sustainable Development (UNCSD)

Title : Sustainability Indicators

Source: http://www.un.org/esa/sustdev/isd.htm

Brief Discussion:

The scope of UNCSD indicators is very broad that aims at overall sustainability. The prime focus of these indicators is at national level rather than at local level at the moment. The major task of UNCSD is to monitor the implementation and to further develop AGENDA 21. Therefore, a working list of 134 indicators is identified (in 1995) and is classified based on the chapters of AGENDA 21. They are divided into four major categories, namely, social, economic, environmental and institutional aspects of sustainable development. The indicator system is developed into the Driving force-State-Response (DSR) framework. This was adapted from Pressure-State-Response (PSR) framework where pressure is replaced by driving force. For each theme and sub theme of AGENDA 21 chapters, driving force, state and response indicators are identified separately.

In Social side, the major themes covered by UNCSD are equity, health, education, housing, security and population. On environmental sides atmosphere, land, fresh water, ocean, sea, coastal area and bio-diversity are major themes. Economic structure, consumption and production patterns are covered in economic theme. Finally, major themes in institutional side are institutional framework and institutional capacity. These themes are still broad and are categorized into smaller sub-themes so that the indicators could be easily identified for driving forces, state and policy responses of each sub-theme. This is a set of indicators unlike a composite index.

Relevancy to Kitakyushu Initiative:

CSD indicators are very comprehensive, quantitative and address very important issues. These indicators are not aimed specifically to the environment but environment is recognized as a major component of sustainability and is covered in detail. For using some of those indicators to Kitakyushu Initiative, they should be tailored to urban context with data availability consideration. However, the indicator cannot describe urban environmental fully because it is not meant for. Also, the indicator system does not provide indications on how to design and implement a policy.

4.3 Environmental Sustainability Index

Organization: World Economic Forum with Yale Center for Environmental Law and Policy and Columbia University Center for International Earth Science Information Network

Title: Pilot Environmental Sustainability Index (ESI): An initiative of the Global Leaders for Tomorrow Environment Task Force

Source: http://www.ciesin.org/indicators/ESI/pilot_esi.html

Brief Discussion:

This index is a composite measure of environmental sustainability unlike UNCSD that is targeted to overall sustainability. The index was presented at World Economic Forum meeting at Davos, Switzerland in 2000. The index is constructed at national scale and covers 56 economies. The indicator system loosely follows Pressure-System-Response (PSR) framework but two additional components are added which deal with vulnerability and global stewardship. Five components that make ESI are: environmental systems, environmental stresses and risks, human vulnerability to environmental impacts, social and institutional capacity to respond to environmental problems, and global stewardship. These five

components are further expanded into 21 factors. Variables are assigned to each factor to describe it most effectively in quantitative terms. A total of 64 variables are identified.

The distinctive feature of this index is to include the human vulnerability and global stewardship towards environment in the indicator system. It is claimed that, these added components are important when one moves from "environmental indicators" to "environmentally sustainable indicators". The methodology used in ESI is very clear and concise.

Relevancy to Kitakyushu Initiative:

ESI is targeted at national environmental sustainability unlike local one. In urban environmental context, the policy settings and priorities are clearly different from national settings. More precise response indicators are possible at local context and the indicators should be able to reflect both global and local environmental responses and concerns. The methodological framework, method of aggregation of the variables, and issues addressed are of great importance to Kitakyushu Initiative indicator system development. Many of the variables have potential to serve as Kitakyushu Initiative indicator.

4.4 Policy Performance Indices

Organization: European Commission, Eurostat/Environment Unit

Title: A European System of Environmental Pressure Indices

Source: http://esl.jrc.it/envind/

Brief Discussion:

These indices are aimed typically at policy performance and are constructed at national level. A total of 60 indicators are identified that are divided into 10 policy fields. Each policy field is described by six pressure indicators. Policy fields covered are: air pollution, climate change, loss of bio-diversity, marine environment and coastal zones, ozone layer depletion, resources depletion, dispersion of toxic substances, urban environmental problems, waste and water pollution. The indicators cover Six target sectors, that are: energy, agriculture, transport, industry, tourism, and waste management. EUROSTAT/Environment Unit of European Commissions regularly publishes these sixty indicators and research on further extension if being carries out. Driving force-Pressure-State-Impact-Response (DPSIR) framework is used to develop the indicator system. DPSIR is an extension of PSR model developed by Anthony Friend in the 1970s, and adopted in OECD's State of the Environment (SOE) studies.

The long-term goal of the program is to replace current indicators such as GDP, unemployment rate etc. by a Policy Performance Index. Physical phenomenon such as urban environmental problems, would be aggregated to 10 sub-indices. These 10 sub-indices will then be aggregated into three major indices (economic, environmental and economic performance) and to a single Policy Performance Index.

The indices are the graphical depiction of performances with the help of colors and ranked as good, bad, very bad etc. This is a unique way of looking into the policy performance rather than with typical numbers.

Relevancy to Kitakyushu Initiative:

PPI starts from respective policy fields, and is clear and concise in conveying the meaning of the indices. The strength of this methodology is a clear distinction of weighing and valuation techniques. Valuation is

done at multi step levels with color codes from green to yellow, for very good, good, satisfactory, serious and very bad. The environmental policy issues considered and sectors addressed are of interest to Kitakyushu Initiative. Its aggregation technique is interesting. However, the initiative is focussed at national level and indicators for urban environmental problems are limited for our use. More detail indicators are needed for Kitakyushu Initiative which could be very different in nature and scope. Also the priorities and importance of issues in cities of the developing countries will have to be given serious thought.

4.5 EU Local Sustainability Indicators

Organization: European Union/Expert Group on the Urban Environment

Title: Towards a Local Sustainability Profile - European Common Indicators

Source: http://www.sustainable-cities.org/indicators/

Brief Discussion:

European common indicators is a monitoring initiative with focus on local level sustainability. Ten indicators for local sustainability are identified in this initiative and testing of the indicators is underway. The initiative was started in 1999. Till this date, 91 local cities have participated in the initiative and first set of data is expected to arrive by autumn 2001. Five indicators are designated as a core indicators and remaining five as voluntary.

Core indicators:

1. Citizen satisfaction with the local community
    - Level of citizen satisfaction in general and with regard to specific features in the municipality
2. Local contribution to global climatic change
    - Annual CO_2 equivalent emissions
    - % variation with respect to a base year, preferably 1990
3. Local mobility and passenger transportation
    - Number of daily trips and time taken per capita by type of trip and by mode of transport
    - Total average daily distance transport
4. Availability of local public green areas and local services
    - Number of inhabitants living within 300 m of open areas or services / total number of inhabitants
5. Quality of local outdoor air
    - Number of times that the limit values for selected air pollutants (SO_2, NO_2, PM_{10}, CO, and Ozone) are exceeded
    - Existence and level of implementation of air quality management plan

Voluntary indicators:

6. Children's journey to and from school
    - % of children travelling by each mode of transportation
7. Sustainable management of the local authority and local businesses
    - Share of public and private organizations adopting and using environmental and social management procedures
8. Noise pollution
    - Share of population exposed to long-term high level of environmental noise
    - Noise levels in selected areas of the municipality

- Existence and level of implementation of a noise action plan.

9. Sustainable land use
   - Artificial surfaces as a percentage of the total municipal area
   - Extent of derelict land (area, m^2) and contaminated land (area, m^2)
   - Number of inhabitants per Km^2 of "urbanized land" area
   - Quota of new edification taking place on virgin area (green field) and quota taking place on derelict and contaminated land (brown field in total area as soil projection) in % per year
   - Restoration of urban land
     1. Renovation, conversion of derelict buildings (floor surface in m^2)
     2. Redevelopment of derelict land for new urban uses - including public green spaces (area, m^2)
     3. Cleansing of contaminated land (area, m2)
   - Protected areas as a percentage of total municipal area
10. Products promoting sustainability
   - Share of eco-labeled, organic, energy-efficient, fair-trade, certified timber products in total consumption
   - Availability and market supply of eco-labeled, organic, energy-efficient, fair-trade, FSC certified timber products

Relevancy to Kitakyushu Initiative

The focus of the initiative is urban sustainability but environment is well incorporated into the indicator system. The priorities and issues of urban area addressed here are very specific to cities of the developed countries. However, some components are useful to Kitakyushu Initiative. Waste sector is not included and indicator system cannot address and reflect urban environmental management strategies of Asian cities into it well. Since the system itself is in testing phase, aggregation and further development/refinement is expected.

4.6 Urban Environmental Quality Examination System

Organization: State Environmental Protection Administration (SEPA)/China (PRC)

Title: Urban Environmental Management in China

Source: SEPA publications

Brief Discussion:

Urban Environmental Quality Examination System (UEQES) measures the environmental performance of the Chinese cities in terms of selected indicators. So far, 46 cities of China have joined to UEQUES program. SEPA publishes a list of top 10 cities each year based on this examination system. A total of 26 indicators is identified and is divide into four categories, namely, environmental quality, pollution control, environmental construction, and environmental management. A scoring system is developed depending on the assigned weight to individual indicators. The weights of ambient environmental quality and pollution control are assigned relatively higher. The units of the indicators are mostly relative, i.e. in %, to allow comparing amongst the cities. The coverage of each category is the following:

Environmental quality: Annual daily average of TSP, annual daily average of SO_2, annual daily average of NOx, drinking water source quality compliance, ambient surface water compliance, average noise value, and average of traffic noise

Pollution control: Smoke and dust control coverage, ambient noise control area for compliance coverage, industrial wastewater effluent compliance, vehicular emission compliance, industrial solid waste comprehensive utilization, and hazardous waste disposal

Environmental construction: Domestic wastewater treatment, centralized heating, urban gas supply, urban domestic garbage treatment, green area coverage, and protection of natural conservation area coverage

Environmental management: Index of environmental investment, environmental institution building, compliance with rule of three actions implemented at the same time, pollution levy, and operation rate of wastewater treatment plants

Relevance to Kitakyushu Initiative:

The scope of the UEQES is very similar to Kitakyushu Initiative. The response strategies of the local authorities are well incorporated into the indicators such as built up of urban environmental infrastructure, % compliance of rules and regulation etc over time. However, this system has not paid adequate attention to the public participation, role of civic society and community into the response strategies. The examination system can provide the ratings of the cities on their overall environmental achievement but cannot measure and evaluate the progress of the selected policy packages and also it does not give idea on how to design and implement a policy packages.

4.7 Core Set of Indicators for Environmental Policy Reviews

Organization: Organization for Economic Co-operation and Development

Title: OECD Core set of Indicators for Environmental Performance Reviews

Source: http://www.oecd.org/env/indicators

Brief Discussion:

The scope of these indicators is of national scale. This is the set of indicators without aggregation to a single index. In this indicator system, 14 environmental issues are identified under Pressure-State-Response framework. For each issue, number of indicators of environmental pressures, environmental conditions and societal responses are constructed that deal with various sectors such as industry, households, transportation etc. The issues identified are: climate change, stratospheric ozone depletion, eutrophication, acidification, toxic contamination, urban environmental quality, biological diversity and landscape, waste, water resources, forest resources, fish resources, soil degradation and general indicators. The long-term and short-term indicators for each issue are also demonstrated.

The strength of this indicator system is its powerful and clear indicators. The response indicators have covered many areas satisfactorily that policy responses are to be focussed at national scale. For example, in climate issue, the response indicators include, energy intensity, implicit and explicit tax on energy/CO_2, expenditure on energy efficiency, alternative energies, and climate change research. Response indicators for urban environmental issues include changes in green space, regulation on emissions and noise levels for new cars and expenditure on water treatment and noise abatement. Similarly for waste, include charges for waste disposal, expenditure on waste collection and treatment, and waste recycling and recovery rates. Response indicators for acidification include expenditure for air pollution abatement, percentage of car fleet equipped with catalytic converters and capacity of SOX and NOx abatement equipment of stationary sources.

Relevancy to Kitakyushu Initiative

The issues taken are mostly physical in nature but a general indicator at the bottom addresses many important indicators that cannot be incorporated into the physical issues. Some of the issues, namely, eutrophication, urban environmental quality, waste, water resources and general indicators are of much importance to Kitakyushu Initiative. Although issues are addressed at national level in this indicator system, it might be possible to get such data for local level. For issues such as acidification, climate change, ozone depletion, biological diversity, forest resources, and fish resources, although these issues are important, data availability could be serious hindrance for local level. In Asian region, most of the countries are developing countries, so the issues and responses would have to be more suitable to developing country context.

5. Other Indicator Systems

This section lists few additional indicator initiatives that are not explained in this report. All of these indicators are of national scope and can be obtained from the following addresses.

- The ecological footprint by Mathis Wackernagel and William Rees, http://www.newsociety.com/oeffs.html
- Genuine progress indicator and index of sustainable economic welfare by Redefining Progress, http://www.rprogress.org/pubs/gpi1999/gpi1999.htm
- Living planet index by World Wide Fund for Nature International, http://www.panda.org/livingplanet/lpr/index.htm
- Human development report indices by UNDP, http://www.undp.org/hdro/99.htm
- Well-being assessment by IUCN, http://www.iucn.org/themes/eval/english/samwon.htm

6. Conclusion

6.1 Discussions on Existing Indicator Systems

Various indicator systems were studied as a first step to construct new indicator system of Kitakyushu Initiative. Analyzed studies were either focussed at national level or at local level. Similarly, the scope of the studied indicators was either overall sustainability or environmental sustainability in particular.

Most of the indicator systems followed Pressure-State-Response (PSR) framework or some others derived from it such as Driving force- State- Response (DSR) or Driving force-Pressure-State-Impact-response (DPSIR). Urban Indicator of HABITAT used the framework of project cycle, and designed indicators for selected policy packages under HABITAT agenda. UNCSD followed chapters of AGENDA 21. The other indicator systems analyzed here attempted to integrate the overall environmental conditions and general policy responses into the indicator system.

Similarly, some of the indicator systems aimed to construct a single indicator or an index while others relied on group of indicators. The aggregation techniques employed in constructing an index were unique in terms of weighting and valuation. Most of the indices were quantitative except a European Commission initiative that relied on the color codes to construct Policy Performance Index. It was noted that a multi-level aggregation of the indicators might lead to the loss of the original meaning and become too subjective.

However, the analyses carried out in this study provided a good reference for constructing an indicator system for Kitakyushu Initiative. It helped to identify the issues, policy fields, priority area, and methodology for Kitakyushu Initiative.

6.2 Recommendations for Kitakyushu Initiative

Ideally, an environmental indicator should be simple to understand by stakeholders, measurable with available data, policy relevant, policy responsive and analytically sound. For use in the international arena, they have to be cross-country comparable. However, it is not always easy to get the indicators meeting all these criteria. The indicator system to be developed should not only address environmental conditions but also be able to address comprehensive policy packages with enough indications to policy responses and driving forces.

The type of priorities and responses needed in developing Asian cities might be different from European and developed cities. The indicator system should consider this reality seriously. The selection of suitable issues and theme should be carried out.

The availability of the local/city specific data might be a big problem for setting indicators in developing Asian countries. In this connection, two-step approach might be useful where a core set of indicators would be developed first with the minimum amount of data requirement and later expand to a comprehensive set of indicators.

A survey of the prospective methodologies for indicator development was carried out in this study. DPSIR framework has been widely applied for constructing the indicator systems. In this, isolated chains of cause and effect are identified for each environmental problem and indicators are allocated to each cause and effect. However, DPSIR framework has been criticized for its inability to neglect systematic and dynamic nature of the various processes of causes and effects. Firstly, the "effect" and "impact" mechanisms are complex and cannot be isolated into a single cause and effect. Secondly, impact can become either pressure or state depending on the chains, and thirdly, multiple pressures and impacts are not considered (this is not the exhaustible list of shortcomings). This has given rise to "Systems Approach" in dealing with the indicators recently [3]. However, looking to the systematic aspects of DPSIR framework, this framework seems to be most promising, so far, for Kitakyushu Initiative.

Strictly quantitative indicators have several weaknesses in knowing the environmental situation. The indicator system should addresses both qualitative and quantitative indicators. A set of indicators, instead of a single index is proposed.

Only HABITAT Urban Indicators have been used to address specific policy packages, all other indicators try to evaluate overall city or nations in terms of their environment and environmental policy performances. Kitakyushu Initiative should learn from the experiences of HABITAT.

References:

[1] OECD (1993), OECD Core Set of Indicators for Environmental Performance Reviews, Organization for Economic Co-operation and Development, Paris 1993.

[2] UNCHS (1997), Monitoring Human Settlement with Urban Indicators, United Nations Center for Human Settlement (HABITAT), 1997.

[3] Bossel (1999), Indicators for Sustainable development: Theory, Methods, Applications, International Institute for Sustainable development (IISD).

Indicator Research-Part IV

List of prospective urban indicators (tentative)

1. Air pollution

Driving Force Indicators (demography, urbanization, lifestyle, economic situation, poverty, local government)

- City product growth rate
- City population growth rate
- City population density
- % of city population living in city core area
- Population density in core urban area
- Per capita travel demand
- Per capita energy use, toe/person
- No of cars/1000 population
- No of vehicles/km of road length

Pressure Indicators

- SOx emissions per square km
- NOx emissions per square km
- TSP/SPM emissions per square km
- CO emissions per square km
- HC/VOC emissions square km
- CO2 emissions per capita

State Indicators

- SOx concentration
  - % of days SOx concentration met standard
- NOx concentration
  - % of days NOx concentration met standards
- Particulate matters
  - % of days TSP/SPM concentration met standard
- CO concentration
  - % of days CO concentration met standards
- HC/VOCs concentration
  - % of days HC/VOC concentration met standards

Response Measures and Indicators

A. SOx emissions control

Industrial sources including energy
Improving fuel quality
- % of sulfur in coal
- % of sulfur in oil

Promoting fuel substitution by cleaner fuel
- Share of coal in total energy use

Share of oil in total energy use
% of industries using natural gas
% of industry using oil

Use of end of pipe technologies
% of industries with end of pipe technology such, as FGD, installed

Industrial restructuring
% of industries closed down for not meting SOx control regulations
% of high SOx emitting industries relocated
% of energy intensive industries (primary industries) in total city product

Transportation sources

Improving fuel quality
% of sulfur in gasoline
% of sulfur in diesel

Promoting end of pipe technology
% of gasoline vehicles with catalytic converter
% of diesel vehicles with end-of-pipe technologies

Promoting clean fuel
% of total vehicle fleet with CNG, Battery operated or hybrid engine

Household sources

Promoting cleaner cooking/hot water energy
% of total household with gas connection

Promoting clean space heating/cooling energy
% of household with CHP system (domestic heating system)
% of household served through oil
% of household served through coal

Cross cutting issues

Monitoring system
% of industries complied to emissions control regulations
Number of monitoring stations

B. Dust control

Industrial sources
% of industries complying to dust control regulations
% of industries with end-of-pipe technologies installed for dust control

Streets
% of paved (black topped) road length/area in total road
% of road with road-side green/plantation

C. Vehicle emissions control

Enforcement of regulations
% of vehicles meeting emission standards

Fuel quality control
% of Sulfur
% of ash
% of unleaded gasoline consumption

Average fuel efficiency
Fuel efficiency of car
Fuel efficiency of buses
Fuel efficiency of (mini)trucks for urban good transportation

Promotion of non-motorized transportation
% of non-motorized trip generation
Promotion of public transportation
% of travel demand fulfilled by public transportation
Promotion of alternative fuel vehicles
% of alternative fuel vehicles in total vehicle-fleet
Fuel tax
% of fuel tax on total retail price, gasoline and diesel

D. Air pollution impact minimization

Human health
Average height of the chimney stack from industrial sources
Average population density in core city area
% of respiratory diseases in total OPD cases

E. Local response to global problems

CO2 emissions control
Per capita CO2 emissions
CO2 emissions per unit city product
Ozone depleting substances control

2. Water pollution

Driving Force Indicators
City product growth rate
Population growth rate
Per capita fertilizer use

Pressure Indicators
Total BOD discharged in water sources
Total COD discharge in sea and marine environment

State Indicators
Nitrogen, nitrate and nitrite concentrations in water bodies
Dissolved oxygen concentration
Suspended solids concentration
Fecal Coliform concentration
Average pH level

Response Measures and Indicators

A. Industrial waste water control

Wastewater treatment coverage
% of total industrial wastewater treated
Promoting water recycling
% of industrial wastewater recycled
Promoting better compliance

% of total industrial wastewater meeting local standards

B. Household sewerage infrastructure enhancement

Improving sewerage collection area
% of population connected to sewerage system
Improving sewerage treatment capacity
% of total domestic sewerage treated
Independent sewerage system
% of household with individual septic tank

C. Water supply infrastructure enhancement

Improving water supply system
% of households with access to water supply system
Improving water use efficiency/improving water availability
Per capita water consumption
% of total water demand fulfilled
% of water loss by leakage and others
Improving economic performance
Average monthly water uses charge as a % of monthly income
Sewerage monthly charge as a % of average monthly income
% of water supply cost covered by user charges
% of sewerage disposal cost covered by user charges

3. Solid waste management

Driving force/pressure indicators
Population density, people/sq. km
Average household income/person

State indicators
Total solid waste generation, tons/day (excluding hazardous waste)
Share of household solid waste generation
Share of industrial solid waste generation
Hazardous waste generation, tons/day
% of organic/biodegradable waste in total solid waste

Response measures and indicators

A. Source reduction

Per capita solid waste generation/day
Average annual growth of solid waste generation

B. Promoting recycling, re-use

% of solid waste recycled
% of paper, glass, metal, can/pet bottles in the solid waste recycled
Solid waste recycled, tons/day
% utilization of recycled solid waste

C. Waste treatment infrastructure

% of hazardous waste treated
% of total household solid waste treated (including composting if applicable)
% of industrial solid waste treated
% of area covered by waste collection vehicles
% disposal by sanitary landfill, incineration, open dump, burned etc.

D. Local government's resources and investment

Solid waste user charge/household
% of budget allocated for solid waste management
% of total treatment cost covered by user charges

4. Noise Pollution

Driving force/pressure

No of vehicles/km of road length
Population density in core city area
Average speed of the vehicles in core city area

State Indicators

Average noise value, dB (A)
Average roadside noise, dB (A)

Response indicators

% of area where noise level is below the local standard (if not WHO standard)

5. Urban green space

Driving force indicators

Population growth rate
Population density

State indicators

% of natural green area, forest etc
% of total green area in the city
% of built up surface in the city

Response indicators

Per capita green area available in core urban area
% of green area available in core urban area
% of road with green belt