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01. Guidelines for the Development of Green Economy Indicators in Developing Countries

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The outcome document of the Rio+20 Conference called for the establishment of SDGs as a set of goals, targets and indicators that should guide the post-2015 global development agenda. In particular, the Green Economy (GE) approach was indicated as an effective tool for supporting the elaboration and implementation of sustainable development strategies at the national level, including the identification and selection of indicators that should guide national decision makers in each step of the policy cycle (UN, 2012).

In response to the need for establishing an effective measuring framework for sustainable development, several international organizations are proposing

methodological approaches for the development, identification, selection and use of green economy indicators that are customized to national realities and strategic priorities (Bassi, Bečić, & Lombardi, 2014). Among the various frameworks, as an example, the Green Economy indicators proposed by the United Nations Environment Programme (UNEP) are specifically designed to support the formulation, assessment, monitoring and evaluation of green economy and sustainable development strategies and action plans (UNEP, 2014). This makes so that the green economy is seen as a vehicle, or an action-oriented approach to reach sustainable development (UNEP, 2011a).

On the other hand, since each country has a unique socio-economic and environmental context, the frameworks proposed so far for the adoption and use of green economy indicators need to be carefully assessed and customized. Additional guidance is needed to adapt indicators and targets to the specific requirements of individual countries. Also, the process for the selection of indicators largely varies depending on the scope of the strategy/assessment being implemented, the political-institutional context, data availability and technical capabilities available in the country. In particular, different indicators and approaches might be adopted for elaborating national and sub-national development strategies, and others may be needed to draw spatial plans for the development of a specific geographic location within a country, or for large infrastructure projects that span across countries (e.g. growth corridors).

The process for selecting green economy indicators and customizing existing frameworks is particularly important for developing countries, which are striving to identify the most effective policy packages to simultaneously achieve multiple development objectives such as poverty eradication, environmental preservation, and sustained economic growth.

This paper builds on the work conducted by international organizations, research institutes and other stakeholders in the development of measurement frameworks for green economy and sustainable development, and it seeks to provide guidance to decision-makers in developing countries for the selection and use of green economy indicators along the entire policy cycle, from the identification of worrying trends and the setting of government priorities, to the monitoring and evaluation of the results obtained by strategies and policies over the short, medium and long-term in relation to sustainable development.

The Challenge for Green Economy Indicators

The adoption of a green economy approach represents an opportunity for developing countries to pursue a low-carbon, resource efficient and re silient economic growth while addressing key challenges such as poverty eradication, employment creation and economic diversification, and the overexploitation of natural resources. A green economy is one whose growth in income and employment is driven by investments that (1) reduce carbon emissions and pollution; (2) enhance energy and resource efficiency; and (3) prevent the loss of biodiversity and ecosystem services (UNEP, 2011a). These include investments in human and social capital, and recognize the central position of human well-being and social equity as core goals promoted by growth in income and employment (UN, 2012).

In fact, green economy policies are aimed to avoid the depletion of natural capital stocks (e.g., forests, fish) and the decline of ecosystems goods and services on which developing countries heavily rely for their economic growth and social well being (UNEP, 2011a).

The basic function and role of sustainability indicators generally is to measures and track progress away from or towards the goal of sustainable development as a management tool (Mccool & Stankey, 2004). Green economy indicators can be considered a more specific subset of sustainability indicators that are crucial to inform development planning and processes for sustainability. The integration of green economy principles into national development plans would contribute to reduce the potential negative impacts of large infrastructure projects, and to redirect public investments towards sectors (e.g., renewable energy or sustainable urban transport) that

are expected to increase access of the poor to essential services, such as public transport and electricity while reducing externalities and side effects (Bassi, Lombardi, & Gallagher, 2014). In fact, to design and implement effective development policies in developing countries, economic growth needs to be assessed against the criterion of whether it satisfies demand for higher living standards by an increasing population within tightening environmental and natural resource constraints.

Despite this straightforward descrption, choosing the criteria for developing indicator frameworks that will adequately reflect progress on green economy and sustainable development is challenging. Who gets to set the indicators? Which types of indicators; actionable, descriptive? Policy relevant? How to manage the tension between what can be measured and what should be measured? For indicators to be effective managements tools, it does matter who chose them and how reasonably they can be measured (Mccool & Stankey, 2004).

Review of Current Indicator Initiatives

Several international organizations have proposed sets of green economy indicators as essential tools in the process of establishing a measurement framework for the post-2015 development agenda. Some of these are cross-sectoral, while others prioritize one pillar of sustainable development (e.g. the environment). For example, the OECD green growth measurement framework suggests the combined use of different types of indicators, including (1) Indicators of environmental and resource productivity; (2) Indicators of the socio-economic context; (3) Indicators of natural asset base; (4) Indicators of environmental quality of life; and (5) Indicators of economic opportunities and policy responses (OECD, 2011). On the other hand, the approach proposed by the Global Green Growth Institute (GGGI) focuses on three types of indicators, namely (1) Diagnostic indicators (i.e. environmental pressures); (2) Planning Indicators (i.e., costs and benefits); and (3) Monitoring and Evaluation Indicators (i.e., policy/strategy impacts) (GGKP, 2013).
Another line of research is focused on the establishment of agreed natural capital accounting frameworks in order to facilitate the integration of environmental indicators into national development planning exercises. For example, the World Bank Genuine Savings indicators, or Adjusted Net Savings (ANS), account for changes in all assets depreciation of produced capital, including depletion of natural resources, and future losses owing to carbon emissions (World Bank, 2011). The System of Environmental and Economic Accounting (SEEA) was adopted in 2012 as an international standard for the inclusion of environmental indicators into the System of National Accounts. Similarly to the ANS, the SEEA framework provides a methodology for making the economy-environment linkages explicit and accounted for into the assessment of national performance (UNSD, 2012).
Finally, several initiatives have been launched over the last years with aim to identify the most effective methods for assigning a monetary value to natural capital and ecosystem services. While it is acknowledged that the contribution of nature to human lives cannot be reduced to an economic value, still the assessment of the relation between economic growth and natural capital is needed to create the basis for integrated development planning through the practical implementation of a green economy approach. Two global initiatives are leading the research on (and implementation of) natural capital valuation frameworks: (1) the World Bank-led Wealth Accounting and Valuation of Ecosystem Services (WAVES), and (2) The Economics of Ecosystems and Biodiversity (TEEB) initiative, which brings together expertise from ecology, economics and development to support the mainstreaming of biodiversity and ecosystem considerations into policy making (TEEB, 2010).
The global movement towards the establishment of indicators and measuring frameworks to

support green economy policymaking reveals a growing interest of national governments towards the adoption of an integrated approach for the mainstreaming of sustainability issues into development plans (i.e. the measurement of cross-sectoral and distributional impacts of green economy policy interventions). On the other hand, what is really needed to support developing countries in their development planning exercises? How can we reconcile the need to assess the outcomes of policy packages (rather than individual interventions) across sectors and actors, as well as over time? How to use indicators to identify the mergence of side effects, or synergies going forward?

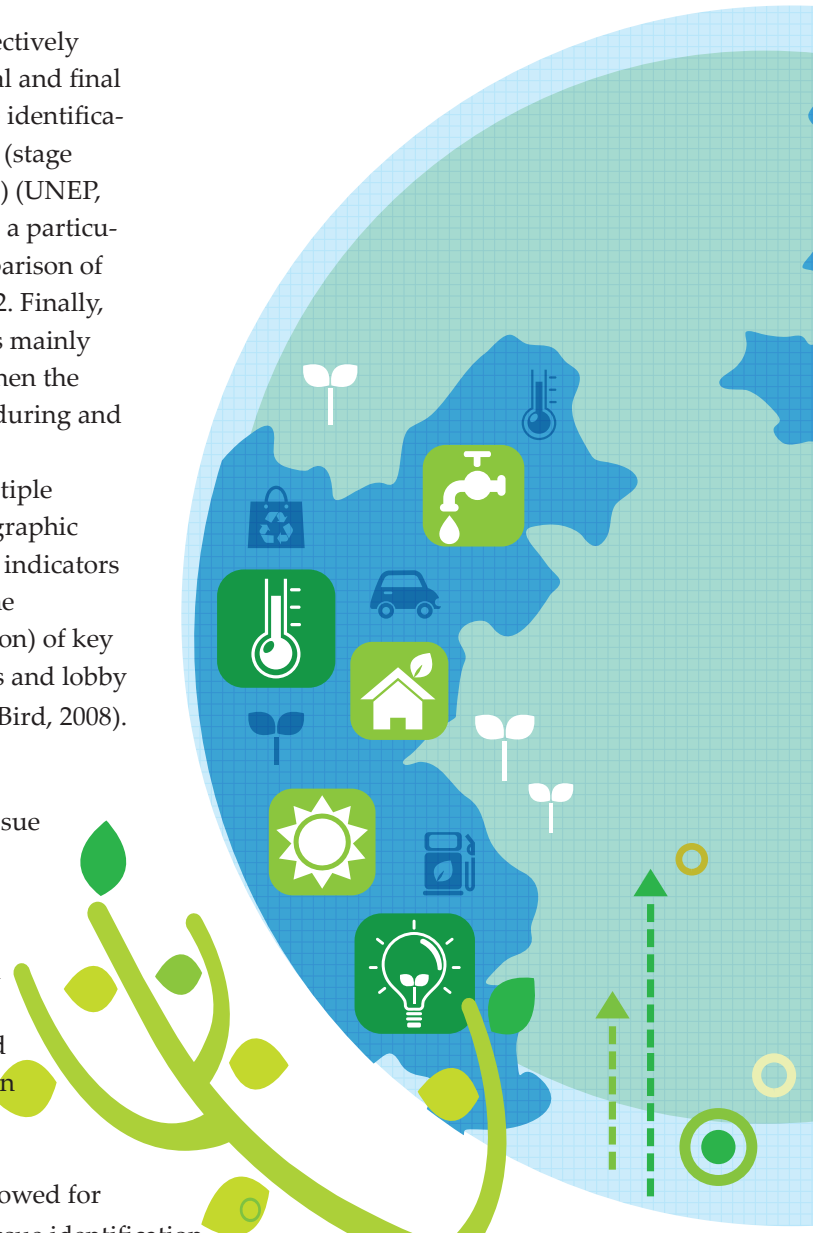
To answer these questions we need to analyze the policy processes being undertaken in developing countries. The type and number of indicators to be selected largely varies depending on the nature and scope of each planning process. In fact, long-term national development planning (e.g., national visions) is generally supported by the use of aggregated indicators that focus on broad development goals and targets. Benchmarks are used in the vast majority of cases, where decision makers try to learn as much as possible from success stories and best practices (e.g. the Global Competiveness Index (WEF, 2014)). On the other hand, mid-term plans and budgetary exercises should be informed by a more comprehensive set of indicators across sectors, in order to facilitate the implementation of targeted policies, and avoid potential unintended consequences of interventions at the local and regional level. Furthermore, sustainable development plans might be focused on a specific landscape, for which spatially explicit (or territorial) approaches to indicator development are required in order to visualize the state of the environment in a given geographical area, and assess the impact of human activities on natural resources and ecosystems (e.g., land-use and marine plans).

As a result, while green economy indicators can be relevant for all planning processes (as they highlight the interconnections existing between sectors and actors), they have to be carefully selected. In fact, while the main characteristics of green economy indicators are similar, there is no single set of green economy indicators that can universally, and effectively support (or should be used to inform) all planning processes. At best, any proscribed framework can be, a starting point for engagement and discussion around selection criteria and not solution that will meet the needs of every context.

Guidelines for Selecting Green Economy Indicators in Developing Countries

GE indicators (Mccool & Stankey, 2004), when used to effectively inform decision making, are designed to support the initial and final stages of the development planning process, namely issue identification (stage 1), strategy/policy formulation and assessment (stage 2), and strategy/policy monitoring and evaluation (stage 5) (UNEP, 2014). Decision-making (stage 3) is the point in time when a particular policy recommendation is adopted, based on the comparison of different policy options that were developed under stage 2. Finally, the role of indicators in policy implementation (stage 4), is mainly exercised through monitoring and evaluation (stage 5), when the actual impacts of development plans are monitored both during and after implementation.

As presented in the next sections, the collaboration of multiple national stakeholders across domains, ministries and geographic scales is critical for the selection of a comprehensive set of indicators at each stage of the policymaking process. In particular, the meaningful participation (as opposed to formal consultation) of key actors from the public and private sector, technical experts and lobby groups should guide the step-by-step process (Lawson & Bird, 2008).



Issue Identification

Several indicators could be selected and analyzed in the issue identification phase of the planning process. In particular, emphasis should be put on those indicators that provide information on the stocks (e.g., forests, mineral reserves, public debt) and flows (e.g., annual deforestation, mineral extraction trends, annual deficit) that govern the behavior of the system. The combined analysis of trends is expected to highlight the multiple causes and effects of consumption and production, as well as the role played by past policies and investments in improving or worsening the situation.

UNEP (2014) identifies four main steps that should be followed for the selection and use of green economy indicators in the issue identification phase, namely: (1) identify potentially worrying trends; (2) assess the issue and its relation to the natural environment; (3) analyze more fully the underlying causes of the issue; (4) analyze more fully how the issue impacts society, the economy and the environment.

In developing countries, problems related to climate change, ecosystem management and natural capital depletion are increasingly impacting on socioeconomic performance, thereby challenging the achievement of key sustainable development objectives (Costantini & Monni, 2008). While problems like climate change and ecosystem management are already high in the agenda of decision makers, an integrated approach to the analysis of worrying trends is challenged by several factors related to the use of indicators, including (1) limited availability of historical data, especially on environmental indicators; (2) “silo” approach to the analysis of sectoral trends, impeding the identification of cross-sectoral causes and effects; and (3) limited adoption of integrated methodologies for the analysis of system’s structure and behavior, often leading to

misinterpretation of problems and duplication of efforts. In this sense, the adoption of a rigorous but still flexible approach to the selection and analysis of indicators is expected to improve the effectiveness of the issue identification phase, and ensure that development plans are centered on the main causes and effects of unsustainable practices.

Policy Formulation and Assessment

The policy formulation and assessment phase involves the selection of relevant policy and investment interventions that are expected to address worrying trends and create the enabling conditions for a transition to sustainable development. The steps involved in the policy formulation phase include (UNEP, 2014): (1) identify policy objectives; (2) identify intervention options and output indicators. Once the strategy/policy options have been identified, their advantages and disadvantages should be assessed. The steps involved in the assessment of interventions include (UNEP, 2014): (3) estimate impacts across sectors; (4) analyze impacts on the overall well-being of the population; (5) analyze advantages and disadvantages and inform decision-making. Many developing countries are already actively engaged in the formulation of green economy and sustainable development strategies, policies and action plans. These strategies are generally cross-sectoral, and aligned with the national development vision and sectoral development goals. However, although the systemic linkages between economic, social and environmental dynamics are being more frequently mentioned (although far from being fully understood and coherently presented) at the strategic/visionary level, several challenges are encountered in the implementation phase, when sectoral policies and investment decisions are still designed in silos, showing a reticence to deviate from "tried and tested" though unsustainable development pathways (Boschken, 2013). Green economy indicators could play a central role in overcoming these challenges, for two main reasons: (1) cross-sectoral collaboration would be strengthened, as the selection of green economy indicators in the policy formulation and assessment phases require the engagement of multiple stakeholders at different levels; (2) policy targets and expected policy outcomes are assessed based on evidence from the analysis of green economy indicators, thereby facilitating the agreement on key intervention options, and the establishment of accountability and monitoring frameworks.

Policy Monitoring and Evaluation

The last stage of the policy cycle consists in the monitoring and evaluation of policy/strategy impacts. In this phase, the actual results obtained by green economy and sustainable development strategies are measured and evaluated in order to address potential gaps and unintended consequences, as well as to inform future development planning processes based on lessons learned. The performance of the strategy/policy implemented has to be evaluated with respect to the problems identified at the beginning of the policy cycle,

as well as the costs and cross-sectoral benefits identified in the formulation and assessment phase. As a result, three main steps should be followed in this phase (UNEP, 2014): (1) measure policy impacts in relation to the environmental issue; (2) measure policy performance and (3) analyze impacts across sectors and on the overall well-being of the population.
The monitoring and evaluation (M&E) phase is the most challenging phase of sustainable development planning in developing countries. The lack of coherent M&E systems and accountability frameworks, together with constraints related to data collection and difficulties in measuring certain impacts of sustainability projects, contribute to the weakening of monitoring processes, and thus undermine the whole development planning process (Agol, Latawiec, & Strassburg, 2014). In this sense, the step-by-step process proposed for the selection and use of green economy indicators at different stages of sustainable development planning is expected to facilitate monitoring and evaluation efforts as well.

Conclusions

The need for adopting a coherent measurement framework to assess the progress towards the achievement of sustainable development objectives has been widely recognized in international debates and relevant studies (Bassi, Bečić, & Lombardi, 2014). In particular, recent work of international organizations and global initiatives has been focused on the development of green economy indicators as tools to support national decision-makers in the elaboration of integrated and cross-sectoral sustainable development strategies. Research has focused especially on conceptual and thematic categorizations that could be used for comparing environmental, economic and social performance across countries and regions.
While common criteria and guiding principles should be adopted in order to encourage the shift towards a green economy at the global level, the need for adapting green economy indicators frameworks to development planning contexts should not be underestimated, also considering the differences that exist between countries with respect to development priorities, availability and state of natural resources and ecosystems, and socioeconomic conditions.
In this sense, developing countries have the opportunity to achieve economic (and inclusive) growth while maintaining or even increasing their natural capital. Starting from these considerations, this paper sought to provide general guidelines on the selection and use of customized green economy indicators in developing countries. Clearly, there is a need for these indicators to be relevant, and as such they should be connected to the national policymaking process, starting from issue identification and ending with policy M&E. In particular, the study suggests that while the indicator selection process should be aligned with the integrated policymaking cycle in order to ensure consistency across the planning process, indicators should also be customized to the specific planning needs, geographical context, and country specificities.

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02. Case Studies for the Development and Use of Green Economy Indicators in Developing Countries

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The overall goal of green economy strategies and policies is to reduce the pressure on the environment and natural resources while ensuring sustained and inclusive economic growth and social well-being. The Sustainable Development Goals (SDGs) proposed by the High Level Panel on the Post-2015 Development Agenda reflect the need to address development challenges holistically, through the combined use of multiple indicators related to economic, social and environmental sectors and issues.

While the SDGs represent a new global governance framework to guide the development discourse, the way in which these broad objectives are pursued by governments largely depends on national development priorities (and hence on the socio-political context), as well as on the type of development planning exercise to be conducted. These generally include (1) regional, (2) national, (3) sub-national and (4) local development plans.

- Regional development plans: guided by regional organizations or transboundary interests, these plans are focused on the achievement of long-term development objectives within a region. The objective of these plans is to create cross-country policy synergies on issues of common interest,

such as the management of shared water courses, regional transport corridors, or protected areas. As a result, they require the identification and use of indicators of regional economic, social and environmental performance.

- National development plans: these plans are focused on the achievement of national development objectives across sectors. They generally include a broad policy framework, which is then further developed into strategic guidelines and sectoral action plans, and at times also investment plans. The indicators used for national development plans are generally aggregated (e.g., GDP, GHG emissions).
- Sub-national (state or provincial) development plans: these are formulated at the state or provincial level, and reflect the development priorities of a specific administrative unit within a country. Green economy indicators used for the elaboration of sub-national plans should be customized to the local context, and provide specific information on natural capital stocks and flows. At the same time, these indicators should be comparable with the ones used at the national level, in order to ensure coherence and consistency and create a standardized framework for monitoring progress towards the achievement of both national and sub-national objectives.
- Local development plans: these plans are focused on shaping the development of a specific location (e.g. municipality or district). In particular, local plans are focused on the sustainable development of a territory, and are subjected to the provisions of long-term spatial plans (e.g., land-use or marine plans). While national development plans use aggregate indicators, local plans are generally spatially explicit, as they allow to assess changes in the state of the environment in a given location, and impact of human activities on natural resources and ecosystems.

In the following sections, four case studies on the development and use of green economy indicators in different planning contexts are presented and analyzed. These include: (1) Regional benchmarking with the Global Green Economy Index (GGEI); (2) GE indicators for national planning in Indonesia; (3) GE indicators for sub-national (state level) planning in Brazil; and (4) GE indicators for landscape planning in Cambodia. The case studies seek to provide concrete examples of the processes that can be followed for customizing green economy indicators to different geographical, political, economic, social and environmental contexts.

Case Study 1. Green Economy Indicators at the Regional Level, the GGEI

The Global Green Economy Index (GGEI) uses indicators to generate a benchmark of the green economic performance of sixty countries (Dual Citizen, 2014). As has been discussed already, green economy indicators should reflect the unique economic, environmental and social characteristics of a country, region or city. However, global indices like the GGEI can also be quite useful in providing an international benchmark defined by a consistent set of topics and themes that can be monitored over time. This offers national policymakers a standardized reference point to understand how their green economic performance compares to others, and insight into reasons for superior or inferior results.

The GGEI is published every two years and the latest 4th edition in October 2014 measured national green economic performance on four dimensions: leadership & climate change, efficiency sectors, markets & investment and environment & natural capital. Given the diversity of countries covered and resulting lack of uniform data coverage, a variety of indicators defined these main dimensions, referenced from global databases, international organizations and in some cases qualitative assessments calculated by its publisher. Also the

GGEI attempts to reference other leading global indices where appropriate – including the Climate Change Performance Index and Environmental Performance Index. This integration of other indices enables policy makers to see the linkages and differences between how each system of measurement approaches the green economy and indicators associated with it.

The GGEI's coverage is cross sectoral, and offers this comparative global viewpoint of four sectors in the latest edition: buildings, transport, tourism and energy. Efficiency sectors like transport or energy tend to have more widely reported indicators to use as proxies for performance, such as carbon emissions from the transport sector or the contribution of renewable energy to domestic electricity production. But buildings and tourism do not offer as readily accessible measures, and arriving at one requires different methodological considerations that policymakers may not always have the capacity to explore. By revealing performance between countries as well as across each sector for individual countries, the GGEI can show policymakers how countries will similar profiles perform, often revealing useful indicators from their work to incorporate or consider.

Importantly, the GGEI also measures perceptions of the same topics and themes defining these four dimensions. These perceptions are gathered from a targeted survey to expert practitioners that have real knowledge and experience in the issues being explored. For example, in addition to measuring the green performance of the buildings sector, the GGEI solicits perceptions of how well each country performs in this regard. In many cases, these data reveal signnificant gaps with performance, indicating to policy makers that practitioner understanding does not correspond to reality. This can have meaningful consequences, particularly with regards to the Markets & Investment dimension where investor perceptions of the climate for green investment and business formation can impact the flow of capital, both human and financial.

The following table offers more detail on the indicators and other data defining the most recent edition of the GGEI. It also gives some examples of why perceptions matter to policymakers in these areas of the green economy.

> Table 1. Key dimensions and indicators of the GGEI (Dual Citizen, 2014)

Dimension	Sub-categories	Types of Indicators, Indices Referenced	Value of Perceptions
Leadership & Climate Change	- Head of state linkages to green economy - Media coverage of national green economy - National behavior in international forums dealing with climate change - Climate Change Performance	- Qualitative measure of association of national heads of state with green economy concept (Google) - Qualitative measure of country coverage in leading global media outlets (Google) - Qualitative measure of country behavior in international climate forums (Climate Action Network) - Quantitative measure of carbon efficiency per capita, per unit of GDP, per unit of primary energy	- Politics are increasingly linked to green economy issues and leadership must be aware of perceptions in this regard - Climate change is becoming a defining issue through which citizens judge their leaders. Having poor perception results here can have real electoral consequences
Efficiency Sectors	- Buildings - Energy - Tourism - Transport	- LEED certification of building construction (USGBC) - Renewable energy as a percentage of electricity production (IEA) - Qualitative measure of national efforts to promote sustainable tourism - Emissions from the transport sector and 10-year trend (IEA)	- Increasingly urbanized global populations demand public investment into infrastructure and efficiency - Travelers are more drawn to "eco-travel" opportunities and will increasingly demand a focus on sustainable travel from countries they visit

Markets & Investment	- Renewable Energy Investment - Cleantech Innovation - Cleantech Commercialization - Green Investment Facilitation	- Renewable Energy Country Attractiveness Index (Ernst & Young) - Global Innovation Index (INSEAD) - Global Cleantech Innovation Index (WWF, Cleantech Group) - Qualitative measure of country efforts at green investment facilitation	- Investment decisions are driven in part by perceptions of market vitality. Confusion in this regard can be costly for national economies - Human and financial capital make decisions about where to start businesses or joint ventures in part through their perception of the vitality of these markets for supporting entrepreneurship
Environment & Natural Capital	- Agriculture - Air Quality - Water - Biodiversity & Habitat - Fisheries - Forests	- Policies related to the effects of farm subsidies and pesticide regulation on agriculture (Yale EPI) - Population weighted exposure to fine particulate matter (Yale EPI) - Loss in forest area from 2000 to 2012 (Yale EPI)	- Consumers increasingly value consuming "organic" agriculture and their perceptions of national efforts to support this are important - Air quality, like climate change, is becoming a defining issue through which citizens judge the performance of their political leaders

Case Study 2 : Green Economy Indicators at the National Level, Indonesia

An example of the process for the selection and use of green economy indicators is the work conducted in the framework of the Low Emission Capacity Building (LECB) project in Indonesia (Sukhdev, Varma, Bassi, Allen, & Mumbunan, 2014). The LECB project aims to develop the capacity of national and provincial stakeholders for the development and use of green economy indicators, as well as the assessment of green economy policies with the help of a dynamic simulation tool, namely the Indonesia Green Economy Model (I-GEM). The key challenge of the project is to support the creation of a coherent measurement framework for guiding the elaboration and implementation of sustainable development strategies at both the national and sub-national (provincial) levels.

The LECB project in Indonesia focuses on the development of three macro indicators, namely Green GDP, GDP of the Poor, and Green Jobs. These indicators were customized to the national and provincial level in order to measure progress towards the achievement of four key goals of the Indonesian government, namely the transition towards pro-growth, pro-jobs, pro-poor, and pro-environment development and to facilitate their inclusion in Indonesia's Medium Term Plan (RPJMN 2015-2019). The three macro indicators identified require panel data collection that reaches the local reality of provinces, including data from households income (cash and non-cash) and consumption, natural capital stocks and flows, and sectoral employment trends. This integrated process seeks to facilitate the inclusion of social and environmental development challenges perceived at the provincial level into the central government agenda, thereby allowing national policymakers to make more informed decisions about where investments should be directed in order to preserve key natural assets while improving the living conditions of the poor. These indicators are also selected as their key drivers directly address at the goals of the government. In other words, three indicators allow to track the performance across several dimensions of development.

Table 2 table provides an overview of each indicator, including its purpose, the data required for its calculation, and the key steps implemented in the framework of the LECB project for measuring the indicators (Sukhdev, Varma, Bassi, Allen, & Mumbunan, 2014).

Table 2. Green Economy indicators developed in the framework of the LECB Indonesia project

Indicator	Purpose	Data requirements	Key steps for measuring
GDP of the Poor	It measures the value of household income of rural and forest-dependent communities, including economically invisible ecosystem services	- N. of households - Cash and Non-Cash income of households derived from natural resources (e.g. forests, soil) - Natural resources stocks - Economic value of natural resources and ecosystem services	1. Select villages depending on provincial context (e.g., riverside, forest, rural) 2. Select a number of sample households 3. Submit questionnaires to households to elicit information about sources of cash and non-cash income 4. Analyze data from households to estimate the share of income attributable to natural resources
Green Jobs	It measures the impact of policy interventions on the nature and number of new jobs created or old jobs lost due to the green economic transition	Data on employment disaggregated by sector, as well as geographic areas	1.1 Review available data on employment trends across sectors 2.1 Identify key and relevant green sub sectors and activities based on international standards (e.g., ILO) 3.1 Generate employment estimates 4.1 Engage with "social partners" of the economy in order to discuss employment conditions within the identified green sub-sectors 5.1 Validate results and green jobs estimates through multi-stakeholder consultations
Green GDP	It measures environmentally sound growth, including an estimation of invisible economic benefits from ecosystem services, and accounting for depreciation of natural capital	- Direct (e.g., timber) and indirect (e.g., carbon storage) use values of forests. - Annual rents from crop lands - Economic value of soil degradation - Surface and groundwater stocks - Economic value of groundwater stock losses - Subsoil assets (e.g., coal, petroleum, natural gas) - Depreciation of subsoil assets. - Public investments in human capital (education and health)	1. Collect data on natural capital stocks 2. Calculate the value of ecosystem services losses and natural capital losses, using methods such as replacement costs, loss of productivity and maintenance cost methods 3. Estimate Green GDP by subtracting the economic value of natural capital and ecosystem services losses from national GDP figures

Case Study 3: Green Economy Indicators at the Sub-national Level, Minas Gerais, Brazil

Climate change poses a variety of challenges to the Brazilian economy, society and environment. Rising average temperatures may increase the occurrence of droughts and threaten water security in most parts of the country, with negative consequences for the well-being of the population and the competitiveness of the national economy. The state of Minas Gerais is particularly affected by climate change. For example, the economic losses deriving from extreme weather events amounted to about R$ 5.8 billion from 2007 to 2013 (FEAM, 2014). The situation will further deteriorate if no action is taken to increase resilience and reduce GHG emissions, as climate change costs are projected to reach approximately R$ 450 billion by 2050 (cumulative amount), without considering the impacts of extreme events (FEAM, 2011).

Given the magnitude of climate change threats, the State of Minas Gerais prioritized the development and implementation of an Energy and Climate Plan (PEMC). The PEMC is a cross-sectoral mid-term policy (2020-2030) whose main objectives are: (1) to promote the transition to a low carbon economy, (2) to reduce vulnerability to climate

change, and (3) articulate coherently different already developed and planned initiatives, within an integrated territorial strategy.
The PEMC includes strategies, guidelines and sectoral mitigation measures in the following sectors: Agriculture, Forestry and Other Land Use (AFOLU); Energy; Industry; Waste; and Transport. The multiple actors involved in the elaboration of the PEMC highlighted the existence of crosscutting issues (and feedbacks) between climate change mitigation and adaptation options, natural capital preservation, and economic productivity. Based on these considerations, the establishment of a comprehensive set of indicators was recognized as an essential requirement for guiding decision-makers through key stages of the policy cycle. To this end, an evaluation of GE indicators with the backdrop of the main PEMC goals was conducted for the selection of the most appropriate sectoral indicators, focusing on (1) problem identification; (2) policy formulation and assessment, and (3) monitoring and evaluation.
Table 3 provides an overview of the green economy indicators that were selected for each of the sectors addressed by the PEMC.

>Table 3. Green economy indicators selected by stakeholders in Minas Gerais to support the elaboration and implementation of the Energy and Climate Plan (PEMC).

Sector	Issue identification	Policy formulation and assessment	Monitoring and evaluation
AFOLU	- Rainfall (mm/year) - Droughts (n. of droughts/year) - Agriculture production (tons/year) - Native Forest cover (ha) - Net CO_2 emissions (tCO_2)	- Increase in protected area (ha) - Reduced deforestation (%) - PES (payment for ecosystem services): funding transferred (US$/year and/or US$/ha) - Incentives for Low carbon Agriculture development (US$/year) - Restoration investment (US$/year and/or US$/ha)	- Increased water supply (L/year) - Agriculture GDP (US$/year) - Employment and income generation from restoration (people/year, US$/year) - Annual harvest of wood products (m3/year) - Net CO_2 emissions (tCO_2)
Energy	- Fossil fuel consumption (Toe/year, US$/year or % of GDP) - Share of renewable energy (%) - CO_2 emissions (tCO_2/year)	- Incentives for renewable energy production (US$/KWh) - Investment in renewable energy (US$/year, % of GDP) - Energy efficiency (% efficiency increase)	- Carbon intensity (tCO_2/Toe) - Employment and income generation from green energy (people/year, US$/year) - Energy consumption per capita (Toe/person/year)
Industry	- Energy intensity (GDP/Toe) - Renewable energy consumption (Toe/year) - Manufacturing GDP (US$/year or %)	- Investment in renewable energy (US$/year, % of GDP) - Energy efficiency: national standards (CO_2 emission % reduction) - Incentives for renewable energy production (US$/KWh)	- Carbon intensity (tCO_2/Toe) - Manufacturing GDP (US$/year) - Energy bill (US$/year)
Waste	- Waste generation (tons/year) - Energy generation from waste (MWh/year) - Waste collection, recycle and reuse (tons/year, %)	- Target for collection, recycling and reuse (%) - Incentive: waste collection, recycle and reuse (US$/year, tons/year)	- Waste recycling and reuse (%) - Reduced water contamination (%) - Employment and income generation from recycling (people/year, US$/year) - CO_2 emissions (tCO_2/year)
Transport	- CO_2 emissions (tCO_2/year) - Air pollution (ppm) - Passenger/km in public transportation system	- Investment: public transport infrastructure (US$/year, % of travel) - Subsidies: public transportation - Incentives: biodiesel	- Transport fatalities (people/year) - Lowered road transport costs (US$/year) - Health (number of air pollution related diseases/year) - Carbon intensity of transport (tCO_2/year)

Case Study 4: Green Economy Indicators at the Landscape Level, SSK, Cambodia

WWF, in collaboration with the Luc Hoffmann Institute and other partners, is implementing the LIVES (Linked Indicators for Vital Ecosystem Services) project *, which seeks to establish a clear link between the Food-Energy-Water nexus and the status and health of the natural systems that provide key ecosystem services. The project is conducting a place-based testing of an approach that integrates land use and economic planning in the Siphadone-Stung Treng-Kratie (SSK) WWF Focal landscape in Kratie Province, Cambodia. This landscape is particularly relevant as it is home to considerable natural capital (upon which the local population relies) and extensive biodiversity, as well being selected for the construction of a new dam and bridge to increase electricity generation (benefiting the whole country) and improve people mobility and transport of goods.

In the context of this project, indicators are used to inform decision making by assessing policy outcomes across the several dimensions of sustainable development. More precisely, the final objective is to provide policymakers with relevant tools to assess the capacity of strategies to deliver national goals while not compromising landscape integrity. Practically, LIVES aims at supporting the government effectively move from the development of strategies and action plans to implementation. Multiple stakeholders at different levels, including villagers, Forest Department officials, NGOs and others, were involved in the selection of indicators. Table 4 provides a list of indicators that were selected to measure the impacts of development policies and investments on the integrity of the SSK landscape, as well as on the livelihoods of the population living in the area. In particular, five categories of indicators were identified, namely: (1) financial indicators: measuring investments, their impact on key economic activities in the area, as well as on income for the local population; (2) physical indicators: assessing the effectiveness of infrastructure in providing access to key services and resources; (3) natural and threat reduction indicators: measuring the effect of interventions on natural capital and ecosystems, as well as the impact of environmental degradation; (4) human indicators: evaluating human well-being, customized to the specific context of the SSK landscape; (5) social indicators: evaluating good governance, institutional effectiveness and law enforcement capacity.

These indicators are then analyzed to consider (a) required investments, (b) policy-induced avoided costs and (c) added benefits.

* For more information please see: http://luchoffmanninstitute.org/projects/navigating-the-water-food-energy-nexus-in-the-greater-mekong/

Table 4. Indicators for measuring impacts of development policies and plans on the integrity of the SSK landscape (selected sample)

Indicator Category	Selected indicators	
Financial	- Household income (1) Income from agriculture activities introduced by project (2) Income from tourism (3) Income from tree products (on-farm). (4) Income from non-timber forest products (e.g., butterfly farming).	- Investment required - Formal sector employment - Changes in the price of basic products - Changes in cash vs. non-cash income and consumption
Physical	- Average travel time to nearest market - Irrigated land/capita - Better land use planning for expansion of rice fields, sand, cassava and rubber plantation	- Water supply - Water quality - Access to electricity - Housing quality - Number of kiosks selling basic products
Natural	- Deforestation rate - Forest reserves available to village - Native species planted in corridors - Frequency and size of fires - Area of community fisheries	- Soil quality - Presence of bird in the communities - Contaminants such as agricultural pesticides and herbicides and organic pollutants in the fresh water/ dolphin pools - Unsustainable fishing (e.g., over exploitation of fish due to use of electro-fishing and dynamite)
Human	- No. of people that migrate from village to work outside for long periods - Access to diverse nutrition (e.g., chicken, egg) (1) Annual vegetables production/capita (2) Average number of cattle raised (3) Average number of chickens raised - No of water born and hygiene disease incidents	- Capacity building for women - Existence of local sustainability initiatives - Level and use of traditional knowledge
Social	- Proportion of adult population participating in CBOs/interest groups - Operation of Micro credit/self-help groups (SHGs) in village - Operational communal agreement to protect habitat - Improved participation of community in reinforcing laws - Local networks operating amongst the communities in the landscape - Level of enforcement by the government on fish and dolphin conservation rules and regulations	- Patrolling by CFI - Level of awareness/transparency of boundaries/ zones - Co-operation between local institutions and forestry department. - Traditional governance effective dispute resolution mechanisms in place, community rules operating - Perceptions-levels of corruption of government officials Local NGO and informal associations active

Conclusions

Green Economy (GE) is defined as an action-oriented approach to reach sustainable development. As any measure for sustainable development, GE interventions require indicators to measure problems, formulate and assess policies, as well as monitor and evaluate their outcomes. There are many GE indicator frameworks available to policy makers. A common aspect being stressed by all of them is the need for "integration" across sectors and actors. Since developing countries carry out many types of planning exercises, they will ultimately need to use several GE frameworks. Any framework needs to be customized to be effective in supporting planning at the regional, national and sub-national level in context. Starting from these considerations, this paper provides information on the challenges and opportunities of adapting green economy indicators to different geographical areas and their planning exercises was analyzed and addressed with four case

studies. The case studies showed how different indicators were selected depending on the specific goals of several development planning process. A global index (GGEI) was presented as a tool to support benchmarking and identify regional opportunities. In the case of national planning in Indonesia, indicators were developed based on the targets set in the national development vision, and measured using both aggregated data collected at the national level, and disaggregated data at the provincial/household level. Sub-national development planning in the state of Minas Gerais, Brazil is guided by indicators that are designed to articulate policy instruments coherently and support policymakers in key stages of the integrated policy cycle, and that are focused on specific sectors prioritized by state authorities. In the case of local planning in Cambodia, a significant number of specific indicators were identified in order to evaluate the impact of national development policies on economic, social and environmental indicators at the landscape level.

To conclude, while more research is needed on methodologies for developing and using green economy indicators in the context of sustainable development policymaking in developing countries, examples are starting to emerge and can be evaluated for informing policy making. In particular, the study suggests that both indicators and indices could support countries move towards their sustainability goals, being useful for different purposes, but helping to reach a common goal.

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03. Korea's Sustainable Development Indicators: Characteristics and Usage

Kim Eunkyung
CEO, Sustainability Center JiWoo

The concept of sustainable development has its roots in recognizing the limits of growth. The Limits to Growth scientifically proved the common belief that it is impossible for the production and consumption system of the modern industrial society to continuously grow within the finite ecosystem of Earth. Similarly, a set of sustainable development indicators was derived as a critical response to the common use of a single index, GDP, as the quantitative growth measure of a nation. As an "aggregate measure of monetary exchanges in the market," GDP does not accurately reflect the qualitative circumstances of the social community and ecosystem. For example, the damage caused to public

health by the severe air pollution stemming from industrial production processes boosts the profits of hospitals, increasing GDP. Likewise, GDP also rises as more safety locks are sold or the number of attorneys appointments increases, both of which are signs of a deteriorating social order. More seriously, the natural environment, the value of which cannot possibly be calculated, is damaged as GDP grows. Rivers or forests by themselves cannot increase the GDP, but when rivers are dug out, embarkments are built or trees are cut to build a golf course, GDP rises. At the same time, this array of processes ultimately causes the destruction of residents' livelihoods and the local environment in which they live, as well as the collapse of the local community.

In particular, despite Korea's accomplishment of constrictive economic growth in a short period of time, the happiness index is relatively low due to the severe polarization, damaged social communities and extensive demolition of the natural ecosystem*. Korea's sustainable development indicators are designed to overcome such limits to the quantitative growth, and to evenly encompass the economic, social and environmental aspects to reflect the willingness of the national administration to promote the quality of life for people. Therefore, these indicators, beyond being a collection of simple sector indicators, hold the values that should guide sustainable development.

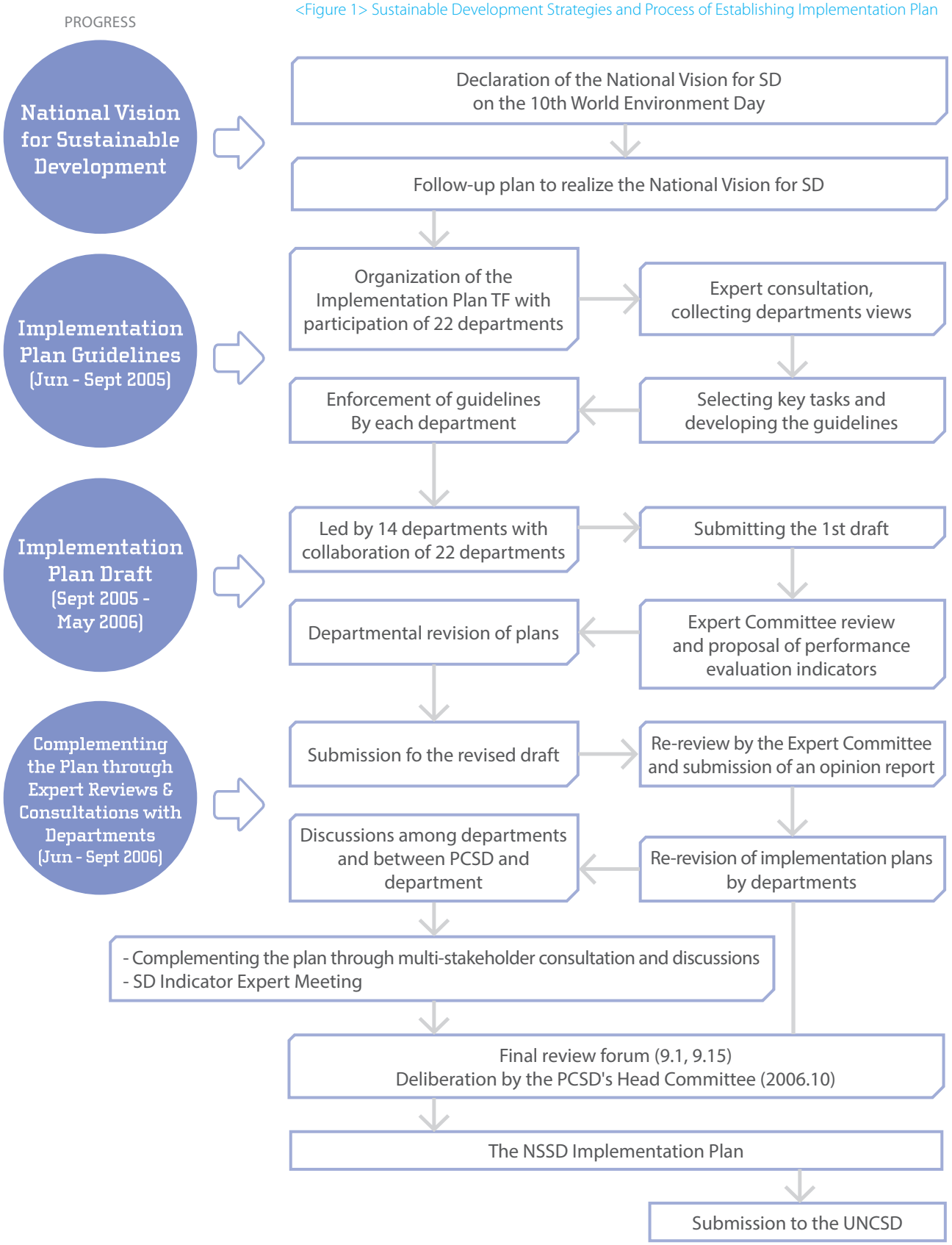
Evolution of Korea's Sustainable Development Indicators

Korea's sustainable development indicators were initially developed based on the project "Establishment of National Sustainable Development Strategies & Implementation Plan and Development of Sustainable Development Indicators" as part of the "Johannesburg Plan of Implementation" of the World Summit on Sustainable Development (WSSD) held in Johannesburg, South Africa in 2002. By 2002, nearly 92% of all local governments in Korea as well as the central government had completed writing the Local Agenda 21. However, the Local Agenda 21 was not implemented as an administrative project of each government, nor did it have its specific implementation plans executed or its results evaluated. In most local autonomous groups, Local Agenda 21 remains declaratory or has diminished to a practical task of the civic society. As a result, a number of recommendations made by WSSD in 2002 have become useful guidelines for the government as it attempts to reflect the passion in Korean society for sustainable development into the workings of the administration. The Korean government set up the tasks of WSSD as a national project for implementation.

A commission on Korea's sustainable development indicators was launched in 2005 and proceeded in tandem with the National Strategies for Sustainable Development (NSSD) and Implementation Plan, which were completed in 2006. The processes were comprehensively led by the Presidential Commission on Sustainable Development (PCSD) which was founded as a presidential advisory body in 2000. PCSD consisted of activists and experts from the government, corporations and civic society and offered a discussion hub to combine and mediate diverse opinions. In addition, the President's sustainable development declaration and order to establish the NSSD Implementation Plan motivated the government departments to participate in the national project. Consequently, an assortment of experts of the civic society and of 22 government departments collaborated on the development of the NSSD Implementation Plan. A set of national sustainable development indicators that is used to measure the state of national sustainable development was confirmed through a public hearing after drawing opinions from each government department and then fine-tuning conflicting ideas among them <see Figure 1>.

* According to the survey of IPOSOS in 2012, citizens of 24 nations who answered "very happy" contributed 22% on average to the total responses, of which Indonesia had the highest happiness index of 51% whereas Korea ranked second from the bottom with a happiness index of 7%, followed by Hungary with 6%.

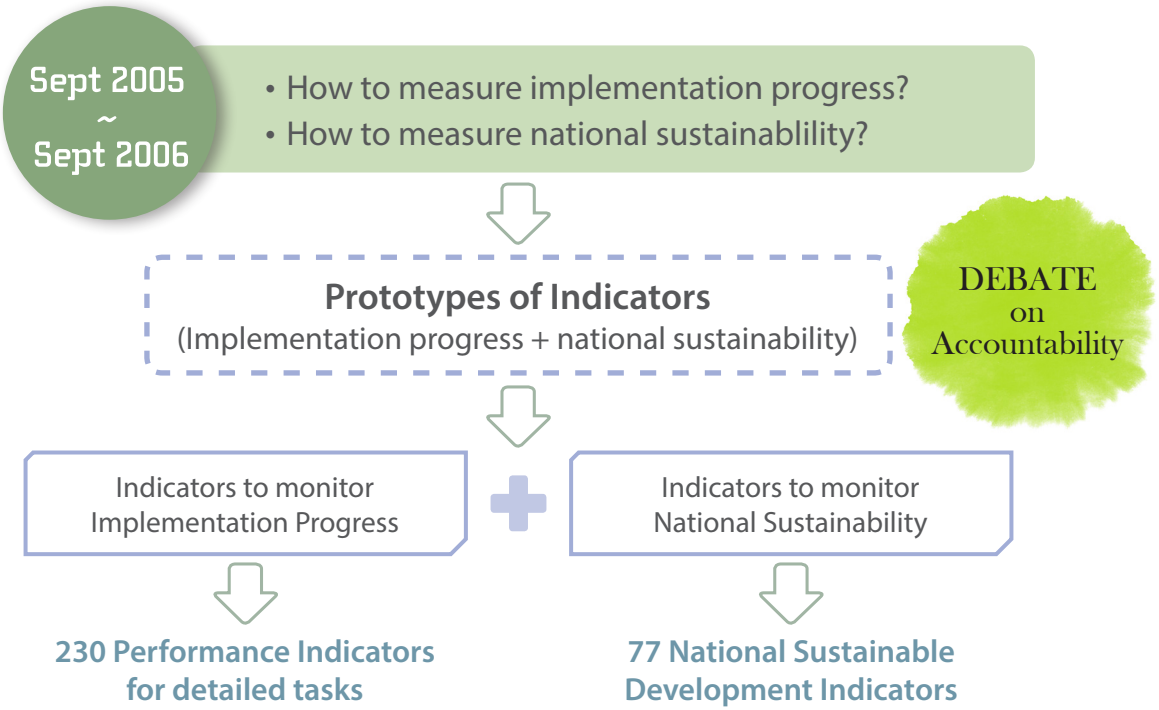
<Figure 1> Sustainable Development Strategies and Process of Establishing Implementation Plan



Source: PCSD Korea (2006), National Strategy for Sustainable Development of Republic of Korea

Korea's sustainable development indicators are not simple indicators to resemble Korea's sustainability. The indicators are closely connected with the specific efforts of each government department to support sustainable development. Along with national sustainable development indicators, 230 performance evaluation indicators were debated and coordinated to evaluate the execution of the implementation plan. These two sets of indicators were reported, together with the NSSD Implementation Plan, to the Cabinet meeting <see Figure 2>.

> Figure 2. Sustainable Development Indicators and Process of Establishing Implementation Plan Progress Indicators



Source: Kim Eunkyung, The Process of the Korean NSSD, Shared Learning and Review Workshop of the National Strategy for Sustainable Development of the Republic of Korea, March 12-16, 2007

Structure of Korea's Sustainable Development Indicators

Korea's sustainable development indicators have established a balanced structure to comprehensively determine the quality of life for people by referring to the national sustainable development indicators of the UN, OECD and many other countries. In addition, the indicator system was developed to suit the situation in Korea by removing non-applicable indicators and adding customized indicators. The key issue of "measurability" on the establishment of indicators relied primarily on the necessity of an indicator, rather than only covering indicators based on measurable statistics. Since sustainable development demands a shift in the policy toward new values and sustainable development indicators must become a compass for the switch, priorities were set to probe whether indicators could induce the switch or not. If necessary, the Korea National Statistical Office (KNSO) was consulted to produce new statistical data in order to incorporate certain indicators. Through such processes, 25 national sustainable development indicators were chosen in the Social Sector, 27 in the Environmental Sector and 25 in the Economy Sector, as highlighted in <Table 1> below.

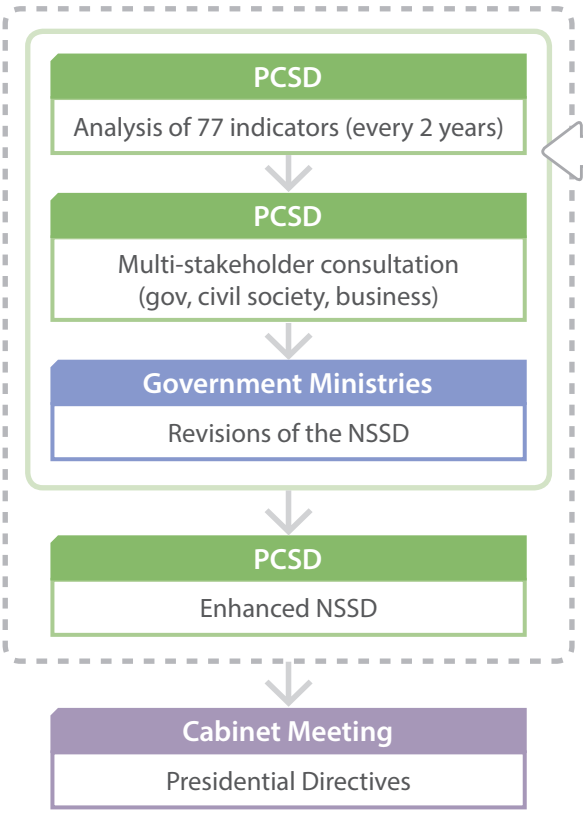
Sector	Theme	sub-theme	indicator
Social	1. Equity	1-1. Poverty	1. Percent of population living below the poverty line 2. Gini Index of Income Inequality 3. Unemployment rate (%)
		1-2. Labor	4. Average working hours
			5. Wage ratio of regular to non-regular work (%)
		1-3. Gender equality	6. Ratio of female to makel wages (%) 7. Percent of women's economic participation (%)
	2. Health	2-1. Nutritional status	8. Nutritional Status of Children (% of required level)
		2-2. Mortality rate	9. Mortality rate under five years old (%)
		2-3. Life expectancy	10. Average life expectancy
		2-4. Drinking water	11. Supply rate of water service in farming and fishing villages
		2-5. Health care diversity	12. Percent of population covered by health care insurance (%) 13. National health & welfare expenditure 14. Percent of children vaccinated against infectious diseases
	3. Education level	3-1. Education level	15. Net percent of children graduating from middle school 16. Number of students per class in elementary schools 17. Education expenditure (cost of public and private education)
	4. Housing	4-1. Living conditions	18. Floor area per person 19. Number of houses per 1,000 population 20. Percent of people without a house
	5. Disaster / Security	5-1. Crime	21. Number fo recorded crimes per 1,000 population 22. Human life and economic loss caused by natural disaster
	6. Population	6-1. Population change	23. Population growth rate 24. Population density (number fo people/km^2) 25. Percent of aged population
Envion-mental	1. Atmosphere	1-1. Climate change	26. Emissions of green house gases 27. Emission of green house gases per person 28. Emission of green house gases per GDP
		1-2. Ozone layer	29. Consumption in metropolitan cities (ppm)
		1-3. Air quality	30. Air pollution in metropolitan cities (ppm)
	2. Land	2-1. Agriculture	31. Percent of farmland area 32. Production ration of Environmental-Friendly 33. Agricultural Products of the Quality-Certificated Self-sufficiency rate of food 34. Use of fertilizers (nitrogen, phosphor) (kg/ha) 35. Use of agricultural pesticides (kg/ha)
		2-2. Forests	36. Forest area as a percent of land area (%) 37. Park area per person within a city 38. Wood harvesting intensity (compared to forest tree reserve)
		2-3. Urbanization	39. Urbanization rate 40. Concentration rate of population in Seoul Metropolitan Areas
	3. Oceans / Coasts	3-1. Coastal zone	41. Algae concentration in coastal waters (Chloryophil, etc) 42. Amount of ocean dumping 43. Sizes and rate of increase and decrease of foreshore area
		3-2. Fisheries	44. Amount of marine resources (10,000 tons) 45. Amount of fishery farming (10,000 tons)

	4. Fresh water	4-1. Water quality	46. Annual withdrawl of ground and surface water 47. Amount of water consumption per person per day
		4-2. Water quality	48. Concentration of BOD, COD, SS, pH (Average in four major rivers) 49. Sewage distribution rate (%)
	5. Biodiversity	5-1. Ecosystem	50. Protected area as a % of total area 51. Number of national species 52. Number of species in danger of extinction
Economy	1. Economic structure	1-1. Economic performance	53. GDP per capita 54. GDP 55. Economic (real GDP) growth rate 56. Investment share in GDP (%) 57. Consumer price indexs
		1-2. Trade	58. Balance of trade in goods and services
		1-3. Financial status	59. Ration of taxation per capita 60. Debt to GDP ratio
		1-4. ODA	61. ODA to GNI ratio
	2. Consumption / Production	2-1. Material consumption	62. Intensity of material use (per GDP $1,000)
		2-2. Energy use	63. Annual energy consumption per capita 64. Total energy supply (per energy sector) 65. Share of consumption of renewable energy sources 66. Energy unit (MJ/HSS)
		2-3. Waste management	67. Generation of industrial and municipal solid waste 68. Generation of hazardous waste 69. Generation of radioactive waste 70. Waste recycling and reusing
		2-4. Transportation	71. Transportation shares per transport mode 72. Total length of roads and cycling paths 73. Number of car accidents (per 1 million people and per 1 million cars
	3. Information Society	3-1. Access to information	74. Number fo high-speed internet subscribers 75. Ratio of households with PCs
		3-2. Information infrastructure	76. Number of on-line civil application services
		3-3. Sciences and technology	77. Expenditure on research and development as a percent of GDP

Source: PCSD Korea(2006), National Strategy for Sustainable Development of Republic of Korea, p31~32

Monitoring System for Korea's Sustainable Development Indicators

National sustainable development indicators should be measured every two years, and a national sustainability report must be written up and published. These indicators are comprehensively evaluated to ensure a balance among the sectors and to check association between indicators, along with any changes that emerge in each indicator. PCSD recommends each department revise or supplement its sustainable development implementation plan through consultation on the indicator evaluation results with various stakeholders, and report the revised or supplemented strategies & implementation plans to the President at the Cabinet meeting.

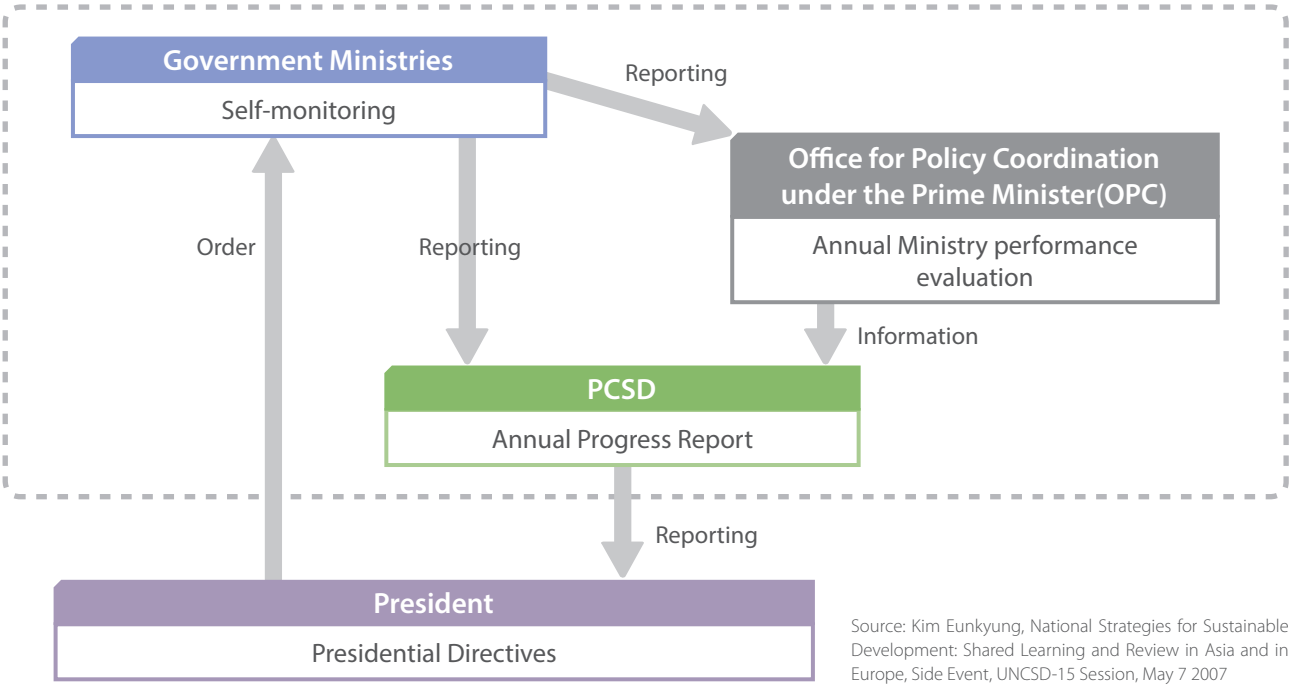


Source: Kim Eunkyung, National Strategies for Sustainable Development: Shared Learning and Review in Asia and in Europe, Side Event, UNCSD-15 Session, May 7 2007

<Figure 3> Assessment & Monitoring System of National Sustainable Development Indicators

Aside from the evaluation of the national sustainable development indicators to assess the overall sustainability of the entire nation, performance results from the sustainable development implementation plan of each department are evaluated annually by the Prime Minister's Office and reported to PCSD. This structure is a practical tool to carry out the NSSD Implementation Plan within the administration. By conducting a linkage analysis between departmental implementation performance and the national sustainable development indicators, PCSD evaluates the appropriateness of the implementation plan and provides opinions on possible revisions. At the same time, this evaluation result is reported to the President and used to encourage the execution of the departmental sustainable development implementation plan.

<Figure 4> Progress Assessment & Monitoring System of Sustainable Development Implementation Plans



Source: Kim Eunkyung, National Strategies for Sustainable Development: Shared Learning and Review in Asia and in Europe, Side Event, UNCSD-15 Session, May 7 2007

Future Tasks

Korea's sustainable development indicators are set up within the framework of the sustainable development promotion system, which incorporates the "sustainable development strategies and implementation plan" and the "development of sustainable development indicators," which were agreed upon by the UN at the WSSD. They were designed to play a crucial role in leading the overall administration to sustainable development beyond the simple meaning of measuring and delivering national sustainability. In addition, they were formatted to presuppose the active role of PCSD, a presidential advisory body planning, supporting and monitoring national sustainable development. Regrettably, the Basic Act on Sustainable Development - on which the sustainable development promotion system was based - was weakened in the course of enacting the Basic Act on Green Growth to proceed with the Four Rivers Development Project. As a result, Korea's sustainable development has been barely maintained by the voluntary execution of a few local autonomous entities, and various national-level functions have been suspended or weakened.

Under the current circumstances, tasks relating to Korea's sustainable development indicators can be largely divided into three dimensions. First, the Basic Act on Sustainable Development should be speedily restored, a goal which has been pursued by the National Assembly Special Commission on Sustainable Development, and the existing systems should be restarted. As the UN picked local autonomous entities as the main body to systemize and promote sustainable development at the Rio+20 United Nation Conference on Sustainable Development (UNCSD) in 2012, the "Basic Act on Sustainable Development of Korea" enacted in 2007 already includes such contents, proving the validity of its reinstatement.

Second, the structure of the sustainability evaluation system must be established. Having operated through 2007, PCSD reviewed major mid/long-term national plans and supplemented national sustainability, but this role was eliminated after PCSD was disbanded. It is essential to restore this feature because it can directly boost the sustainability of administration. At the same time, it takes a long time to revise administrative actions by evaluating changes in the national sustainable development indicators. Moreover, it is also critical to establish a business sustainability evaluation system to address the limits to the present environmental impact evaluation. It is likely that the evaluation of national sustainable development indicators will only have an actual influence when supported by a set of viable sustainability evaluations on the businesses and mid/long-term policies.

Third, Korea's sustainable development promotion system and sustainability evaluation system should be spread to and established in local autonomous organizations. Thus, it is urgent to reinstate the "Basic Act on Sustainable Development" that provides for the promotion of sustainable development by local autonomous organizations.

If these three tasks can be implemented without any setbacks, Korea's sustainable development indicators would be able to fulfill their intrinsic function as guideposts showing the way to a sustainable country and a sustainable world.

04. Korea Environment Institute's Research Projects on the Development of Indicators for Sustainable Development

Developing an Indicator Framework for National Green Growth Strategy: Measurement and International Comparison of Green Growth

Jong Ho Kim et al., 2010

In 2008, President Lee Myung-Bak announced the "low-carbon, green growth" strategy as a new vision that will guide the nation's long-term growth. This new national vision emphasizes the implementation of policies, which promote environmentally sustainable economic development. Furthermore, it fosters developments that are both low carbon and socially inclusive. The green growth strategy has three key objectives and ten policy directions. The three objectives are creating new engines of higher sustainable growth through the development of low-carbon, environmentally-friendly industries; ensuring climatic and environmental sustainability; and contributing to international negotiations whose purpose is to fight climate change.

Due to the wide purview of the green growth strategy, which encompasses major domestic environmental policy questions, as well as Korea's most pressing economic issues, it has the potential to exert enormous impact on environmental quality, natural resources, and socio-economic development. In addition, the green growth strategy requires the input of appropriate information to support policy analyses and to assess progress, which is computed through various indicators that monitor trends and changes. In this study, an indicator framework was developed, and this framework can capture all major aspects of green growth through Korea's Five-Year Plan for Green Growth. The indicators and variables that make up the framework build on the standard composite indicator methodology, and they were chosen through an extensive review of the literature, assessment of available data, and consultation with sectoral indicator experts.

Climate Change Adaptation Capacity Indicators - A Pilot Study for the Application of the Indicators at the Local Level

Jeongho Lee et al., 2010

Climate change is unequivocal with scientific evidence and the impact of climate change is expected to be exacerbated. The impact and damage caused by climate change are various not only at the national level but also at the local level. Thus, local community as well as national level has to assess the vulnerability and impact of climate change and then develop proper adaptation strategies to climate change.

In order to develop efficient and effective adaptation policies and strategies, it is necessary that each local government identifies current policies and adaptation capacity. Prioritization of funding and resource should be implemented based on the evaluation of the climate change impact-adaptation capacity. So far little attention has been paid to assessing climate change adaptation capacity. Thus this study addresses this critical gap by developing climate change adaptation capacity indicators and applying them to 16 local governments as a pilot study.

This study is organized as follows: Section 2 reviews the current literature on climate change adaptation and defines the climate change adaptation capacity. Section 3 discusses existing methodologies to evaluate climate change adaptation capacity including their benefits and limitations. We then develop our own climate change adaptation capacity indicators which evaluate the impacts of the climate change and policies to response them. In addition, we apply them to assess 16 local governments' adaptation capacities. Local municipalities have differed greatly in their impacts caused by climate change and responses. By assessing local adaptation capacity using our indicators, each local government can prioritize the impact of climate change and adaptation policies and monitor their adoption and implementation of adaptation policies.

Developing and Applying Green Life Indicator

Soojeong Myeong et al., 2010

The developed indicators consist of two indicator categories of individual and societal aspects, each of which has two sub-categories. Specifically, the individual category is composed of sub-categories for the knowledge of green life and the practice of green life, and the societal category has sub-categories for the infrastructure of green life and the outcomes of green life. In order to develop green-life indicators, the study conducted a questionnaire-based survey and interviews with the general public. Then, for the selection of indicators for each category, specialists' Delphi analysis was conducted.

To develop a framework for green life indicators, the authors make the following recommendations.

1) Individual aspects – Knowledge of green life: ‘awareness of green life’, ‘attitudes toward the practice of green life’ & Practice of green life: 'reducing food leftovers', 'purchasing environmentally friendly goods', 'using the public transportation system’, etc.

2) Societal aspects – Infrastructure of green life: 'percentage of using usage-based pricing bags for food waste disposal', 'percentage of environmentally friendly goods among overall goods', 'percentage of railroad transportation in the overall transportation system', etc. & Outcomes of green life: ‘amount of waste production per person', 'amount of sale of environmentally friendly goods', 'amount of energy consumption by passenger cars', etc.

Research on the Development of Indicators and an Operating Guideline for Social Impact Assessment

Kong Jang Cho et al., 2011

Social impact assessment is an institutional tool to predict how a proposed project would change the quality of human life and to mitigate potential negative impacts of the project. Because individual or community is a target of the assessment, it is important for various stakeholders to participate and coordinate opinions in the process of the assessment. Considering this character of social impact assessment, we have developed indicators and an operating guideline. In reviewing precedent studies and cases of social impact assessment, we selected indicators concerning population, dwelling, economy, industry, lifestyle, culture, local society, just society, and processes. These indicators aren't fixed lists, such as existing impact assessments, but those are base data which could be modified through public discussions at the scoping stage of social impact assessment by projects. Final indicators of social impact assessment are determined by excluding unimportant indicators, depending on stakeholder's judgment and adding new indicators needed for issues.

The operating guideline for social impact assessment consists of scoping, investigation, prediction, evaluation, mitigation, and monitoring, which is the same as operating procedure of environmental impact assessment. Differences from environmental impact assessment are proposing contents and methods that consider the characteristics of social impact at each stage. Methods of stakeholder analysis and participatory methods of drawing issues at scoping stage, methods of social investigation at investigation stage, methods of qualitative and quantitative prediction at prediction stage, professionals' significance assessment and community acceptability assessment at assessment stage, principals of compensation and political accountability at mitigation stage, and management system of projects at monitoring stage are important elements which should be considered when operating social impact assessment.

Introduction of Environmental Burden of Disease as a National Environmental Health Policy Indicator

Yong Seung Shin et al., 2012

The purpose of this study is to diagnose the possibility of Environmental burden of disease (EBoD) as an environmental health policy indicator and to provide technical and institutional measures for enhancing its utility to policy makers by analyzing the uncertainty factors of EBoD.

In the study, we reviewed the EBoD calculation methodology developed by WHO and calculated domestic EBoDs by using data available in Korea. In addition, uncertainty analysis was carried out in estimating EBoD in Korea.

The results of the study proposed the technical and institutional measures for introducing EBoD as a national environmental health policy indicator in Korea. As technical measures, it was proposed to develop 'Korean EBoD calculation protocol' and build EBoD database in consideration of domestic data availability and environmental concerns. First, it is necessary to define which environmental diseases should be considered in Korea. As institutional measures, we proposed to designate EBoD as a national environmental health policy indicator and monitor it periodically. When technical and institutional challenges are solved, it is proposed to build a 'Korean EBoD system' which can provide services to officials and citizens. The Korean EBoD system is expected to contribute to implementing more efficient and objective environmental health policies in Korea.

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