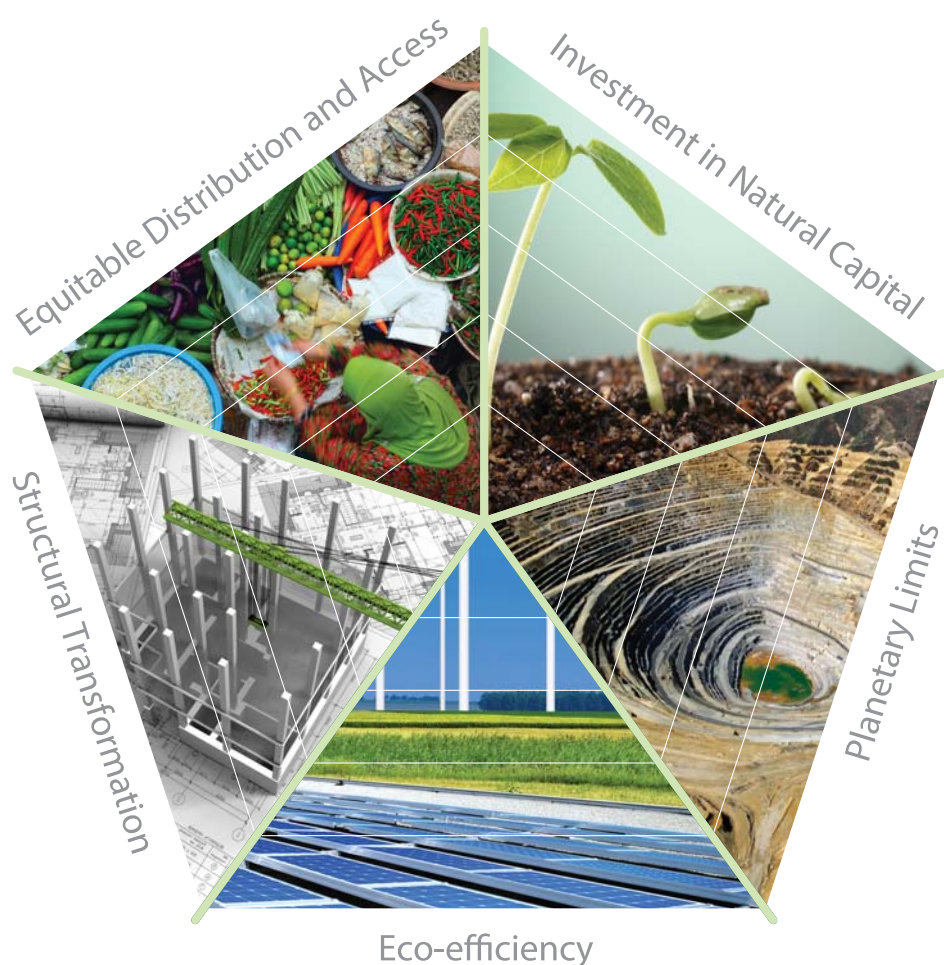




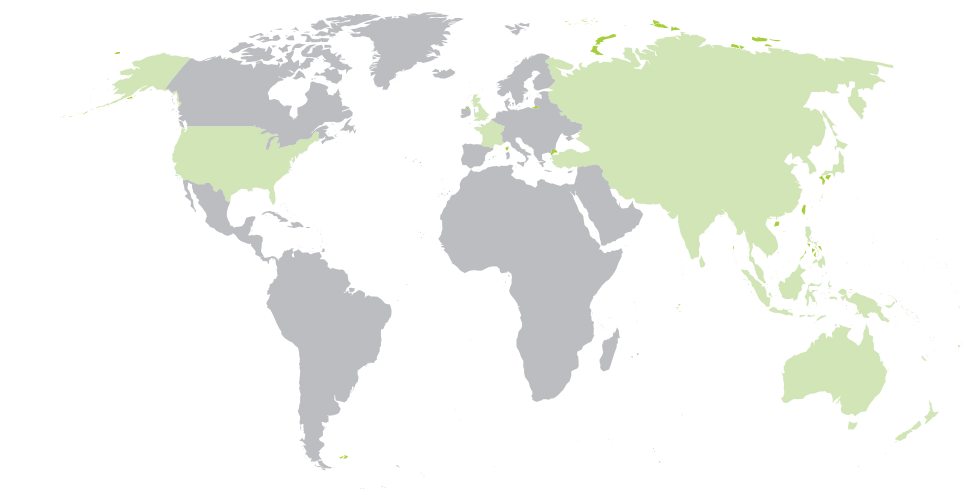
Green Growth Indicators:

A practical approach for Asia and the Pacific



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United Nations publication
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Abbreviations and acronyms

ADB	Asian Development Bank
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Australia)
ESCAP	Economic and Social Commission for Asia and the Pacific
GDP	Gross Domestic Product
GHG	Greenhouse gas
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
SEEA	System of Environmental-Economic Accounting
UNEMG	United Nations Environment Management Group
UNEP	United Nations Environment Programme

Executive Summary

Several countries in Asia and the Pacific have launched high-level policy initiatives and action plans to promote green growth, and the green economy. As a consequence the demand for indicators of economic growth that supports, rather than detracts from, sustainable development, is growing.

Green growth indicator frameworks developed by international organisations and partnerships of organisations share a focus on a few key dimensions. These include human well-being, resource efficiency and productivity, economic transformation, environmental quality and natural capital, as well as policy responses. A review of the green growth policy priorities of many ESCAP member states shows that the policy context and the specific objectives for green growth in developing countries require closer attention to indicators that explicitly address inequality, access to basic ecosystem services, human capital investments (including traditional knowledge); urbanisation patterns and infrastructure development; governance (transparency, accountability and inclusiveness); resilience and a sectoral perspective (including in particular agriculture).

This publication informs policy makers and practitioners involved in developing and monitoring green growth strategies. It proposes a framework for green growth indicators that seeks to respond to the context of developing countries and their expressed policy needs. It reflects ESCAP's mandate and experience in promoting, analysing and advocating green growth in the context of a broader vision of inclusive and sustainable development. In response to the mandate of the United Nations Conference on Sustainable Development (Rio+20) the proposed framework is based on collaboration at the science-policy interface through the partnership of ESCAP with the Commonwealth, Scientific and Industrial Research Organisation of Australia.

The proposed framework for green growth indicators is based on a wider concept of quality of growth, and puts attention on five main dimensions of economic development - equity and inclusiveness; efficiency and productivity; structural transformation; investment in natural capital; and planetary boundaries. ESCAP's framework aligns with previous work on green economy and green growth indicators with particular attention to inequality and access to basic resources. It recognises the need to assess and mitigate risks – to set targets to ensure that economic activity and its resource use consequences stay within planetary limits. The importance of governance for each element of the framework is also emphasized.

Several indicators are identified - some of which are well-known, widely-accepted and for which data is available, while others require further definition and investment for harmonization of methodology and data collection. The indicators proposed are not intended to be comprehensive or prescriptive - they are intended to assist government agencies and businesses to define indicators that address their particular circumstances, and to adapt them to priority economic sectors and specific geographic circumstances.

Future work will be required to refine the indicators, make data available to strengthen the policy analysis capacity through economic modelling for sustainable development, and support governments that wish to develop their own information base and institutional capacity to measure and model green growth policy alternatives.

The policy challenge – aligning economic growth with sustainable development

A convergence of pressure points including rising prices for food, metals and fuels and climate change has changed the economic context of the 21st century. Policymakers increasingly recognize that achieving sustainability rests almost entirely on getting the economy “right.”

Green growth, or environmentally sustainable economic growth, has been recognized in Asia and the Pacific as well as other parts of the world as a strategy for achieving sustainable development to pursue the dual objective of increased human well-being and environmental stewardship.¹

The 2012 United Nations Conference on Environment and Development (Rio+20), addressing the theme of the green economy in the context of sustainable development and poverty eradication, encouraged each country to consider the implementation of green economy policies in the context of sustainable development and poverty eradication to drive sustained, inclusive and equitable economic growth and job creation, particularly for women, youth and the poor. This is of special importance for Asia and the Pacific, a region of fast economic growth but persistent poverty, rising environmental pressures and increasing dependency on imports of natural resources and high vulnerability to climate change.

Green growth is an approach to economic development that fosters environmentally sustainable, low carbon and socially-inclusive development. Green growth turns resource constraints and the climate crisis into economic growth opportunities through investing in economic growth and well-being while using fewer resources and generating fewer emissions in the important domains of food production, transport and mobility, construction and housing, heavy industry, energy and water.

Green growth is a prerequisite for building a green economy and is characterized by substantially increased investments in economic activities that build on and enhance the earth’s natural capital or reduce ecological scarcities and environmental risks – activities such as renewable energy, low carbon transport, energy- and water-efficient buildings, sustainable agriculture and forest management, and sustainable fisheries.

Several countries have launched high-level policy initiatives and action plans to promote economic growth that supports, rather than detracts from, sustainable development. The Republic of Korea declared low carbon green growth as a national vision and strategy in 2008, and established supportive legislation and a Presidential Committee on Green Growth. Japan has initiated a policy principle to develop a sound material cycle society and China has instituted a law for a circular economy based on resource efficiency and a green economy.

Cambodia has agreed on a National Green Growth Roadmap, and Viet Nam has developed a Green Growth Strategy. Kazakhstan, Malaysia and Mongolia also have significant policy initiatives related to green growth, resource efficiency and a circular economy, and other strategies are in the pipeline in many countries in Asia and the Pacific.

These policy initiatives have identified a need for new and comprehensive policy indicators that enable governments to monitor progress towards a green economy in the context of sustainable development and poverty eradication.

A wealth of sustainable development and green growth indicator initiatives

Rio+20 agreed on the need for better indicators of progress² – but this is a long-standing challenge. Among the most prominent of the initiatives to identify indicators that could help guide policymaking on sustainable development was that of the Commission on Sustainable Development which approved a work programme on sustainable development indicators in 1995. The third of three reports to date was produced in 2007.³

More recently, the Stiglitz-Sen-Fitoussi “Commission on the Measurement of Economic Performance and Social Progress” was established by the then President of France, Nicolas Sarkozy. The Commission reviewed indicators relevant to sustainability and made several recommendations that provide an authoritative guide to development of indicators of social progress.⁴

The World Bank has developed measures of Adjusted Net Savings and launched an initiative on Wealth Accounting and Valuation of Ecosystem Services (WAVES).⁵ United Nations University (UNU) and the International Human Dimension Programme on Global Environmental Change (IHDP), in collaboration with the United Nations Environment Programme (UNEP), have developed an Inclusive Wealth Index.⁶

UNDP is expanding and refining its work on human development, proposing a multidimensional poverty index and inequality adjustments to the Human Development Index among other refinements.⁷ The Organization for Economic Co-operation and Development (OECD) has launched the “Your Better Life Index” proposing a flexible index measuring important dimensions of quality of life, based on user-defined weightings, which allows for the tracking of social preferences.⁸

At the country level, India is incorporating ecological values into national accounts as a way of better assessing progress. Chinese researchers have proposed a composite indicator, the Resource and Environmental Performance Index (REPI)⁹ and the Chinese Government has adopted bold targets for energy and resource efficiency.

Several organizations including the OECD¹⁰, the European Union¹¹, UNEP,¹² the United Nations Environment Management Group (UNEMG)¹³ and the Green Growth Knowledge Platform¹⁴ have launched initiatives to monitor progress towards green growth and green economy.

The UNEMG’s approach draws on existing sustainable development indicators work and refers to some initiatives (such as the Human Development Index or Adjusted Net Savings) but does not propose a defined framework to organize them.¹⁵

UNEP’s approach on measuring progress towards a green economy uses environmental issues as an entry point. Indicators of the impact of policy on well-being and social equity, as well as for evaluating policies are also proposed, among others. Other work by UNEP has highlighted the role of environmental assets as a driver of human well-being through a selection of indicators in three dimensions – economic transformation, resource efficiency and progress and well-being.¹⁶ The OECD’s approach focuses on the use of natural resources, environment and resource productivity, quality of life, and policy response.

The Global Green Growth Institute proposes green growth indicators for diagnostic purposes, for planning and monitoring, and for evaluation. The Green Growth Knowledge Partnership¹⁷ brings together several international organizations and proposes an indicator framework based on the OECD approach, but extends the OECD framework to include indicators of the socio-economic context, and to propose wealth accounting (similar measures to “green GDP” based on economic valuation) as a way to evaluate overall progress.

Some shared concerns: human well-being, resource-efficiency and productivity, economic transformation, environmental quality and natural capital, and policy responses

The components of the indicator sets developed under these initiatives can broadly be grouped into five main categories: indicators of well-being, indicators of economic transformation, indicators of environmental quality, indicators relating to resource efficiency and indicators relating to policy responses. A list of some of the indicators related to economic transformation, as identified by some of these indicator frameworks, are shown in Annex 1.

The green growth indicators relating to resource-efficiency and productivity usually include indicators of greenhouse gas (GHG) intensity of production, energy efficiency or material intensity. The Netherlands’

green growth indicators also introduce measures of water use intensity and greenhouse gas emissions of consumption. The OECD framework expands the scope to measures of labour productivity and multi-factor productivity, while the UNEMG proposes analysis by sector (see Annex 1).

With respect to green transformation and economic opportunities and policy responses there are slightly varying responses. The UNEMG approach considers the evolution of the share of green investment, jobs and output. UNEP focuses on policy interventions influencing green investment. OECD or European Union approaches more generally aim “to identify the sources of “green growth” and the relevant policy intervention to lift barriers to green growth”(see Annex 1).¹⁸

Learning from practical application – green growth indicators and policy at the national level

The Republic of Korea was the first country to declare low carbon green growth as a national vision and strategy in 2008, and subsequently set up a comprehensive institutional and legal framework to implement the vision and strategy. The strategy is composed of three main policy goals, ten policy directions and 50 areas of action. Statistics Korea selected 30 indicators in November 2011 to assess policy performance and the implementation level of green growth using the three strategies and ten policy direction settings of the Five-Year plan for Green Growth as a framework. Selection was based on three main criteria: policy relevance, analytical soundness, and data availability. The framework of indicators is summarized and the results of the assessment are presented in Figure 1.¹⁹

In March 2012 Statistics Korea launched a report analysing 23 indicators using the green growth indicator framework developed by OECD to ‘objectively and specifically evaluate the implementation of the Republic of Korea’s green growth policies’. The framework, the indicators chosen and the results of the first years of evaluation are summarized in Figure 2.²⁰

Comparing the two assessments of progress on green growth helps to indicate how well one internationally-accepted green growth indicator framework adapts to the national green growth policy context in a country like the Republic of Korea. Some differences between the OECD framework indicators and the indicators identified as being most relevant to the Republic of Korea’s policy context are found. These differences mainly relate to importance given to certain natural asset indicators; the treatment of lifestyles and consumption patterns; how economic transformation is assessed; and the extent to which there is a focus on measures of policy performance.

One of the main differences is that natural assets indicators presented in the OECD’s framework are not included in the Republic of Korea’s framework. They are considered to be “governed by natural circumstances” and as such according to Statistics Korea they ‘cannot ascertain the policy performance and the implementation level of green growth’²¹. Only a few indicators such as “annual rainfall per capita” were seen as relevant – but indicators that highlighted policies addressing water shortage risks (dam construction, river restoration and groundwater development) were seen as more likely to be useful. The relevance of the share of aquaculture to assess stocks of fish is also questioned.

The Republic of Korea’s framework pays considerable attention to evolution of lifestyles, in particular consumption patterns and urban environments – in contrast with OECD framework. The Republic of Korea’s framework gives more attention to the process of industrialization and structural transformation, including indicators relating to enhancing industrial structures that are not included in the OECD framework. Finally, the Republic of Korea’s framework’s stronger focus on measures of policy performance and implementation of green growth strategy is reflected in the higher number and variety of indicators in this dimension. An interesting element in the Republic of Korea’s framework is found in the reference to the “share of green ODA (Official Development Assistance) in ODA” – where such a notion is a prominent omission in the OECD framework.

FIGURE 1: A Set of green growth indicators, Republic of Korea (national policy)

3 Sectors	10 Policy Direction-Setting	Green Growth Indicators	2005~2009	
			Recent Trend*	Assessment
Climate Change Responses and Energy Self-reliance	Effective reduction of GHG emissions	GHG emissions per unit of GDP	↘ ↗	☀
		Total GHG emissions	↗	☁
		GHG absorption by forests	↗	☀
	Enhancing energy self-reliance for post petroleum	Energy consumption per unit of GDP	↘ ↗	☀
		Share of self-development of oil and gas	↗	☀
		Share of new and renewable energy	↗	☀
	Enhancing climate change responses	Self-sufficiency rate of food	↘ ↗	☁
		Accuracy of rainfall forecast	↗ ↘	☀
		Government budget deicated to disaster prevention	↗	☀
Creating New Growth Engine	Planning green technology development for growth engine	Share of green R&D in government R&D expenditures	↗	☀
		Share of GDP dedicated to total R&D expenditures	↗	☀
		Number of international patent applications	↗	☀
	Greening industries and fostering green industries	Domestic material consumption per unit of GDP	↘	☀
		Share of environmental industry sales	↗	☀
		New and renewable energy industries	↗	☀
		Share of service industries VA	↗ ↘	☁
	Enhancing industrial structures	Share of knowledge intensive industries VA	↗	☀
		Share of Information and Communications industries VA	↗	☀
	Forming foundation for green economy	Government-purchased GHG reduction	↗	☀
		Number of ISO14001-certified businesses	↗	☀
		Share of environmental taxes in overall revenues	↘ ↗	☁
Improving Quality of Life and Enhancing National Status	Creating green territory & transportation	Urban green space per capita	↗	☀
		Share of public passenger transportation	↗ ↘	☀
		Share of GDP dedicated to environmental protection expenditures	↗	☀
	Green revolution in life	Household energy consumption per capita	↘ ↗	☀
		Municipal water use per capita	↘	☀
		Municipal waster generation per capita	↗ ↘	☁
	Becoming a role model nation of green growth	GHG reduction certification under CDM	↗	☀
		Share of ODA in GNI	↘ ↗	☁
		Share of green ODA in ODA	↗	☀

* Marked as a small arrow in case that a recent indicator is out of existing trend.

SOURCE: Statistics Korea, *Korea's Green Growth, Based on OECD Green Growth indicators*, (Seoul, Kostat, 2012), accessed from <http://kostat.go.kr/koreasGreenGrowth/EBook.htm> on 10 November 2013

FIGURE 2: Green growth indicators, Republic of Korea (OECD framework)

1. Environmental & Resource Productivity		
Subject	Indicators	Trend
Emissions	GDP/GHG emissions	Improving, but stagnant in 2009
Energy	GDP/Primary energy consumption	Improving, but stagnant in 2009-2010
	Share of Renewable energy	Improving, but short of target rate
Material	DMC/GDP	Improving
	Municipal waste per capita	Insufficient but improved in 2009
	Chemical fertilizer/arable land	Improving; improved greatly post-2008
Water	Municipal water per capita	Improving but stagnant in 2010

2. Natural asset base		
Subject	Indicators	Trend
Water	Rainfall per capita	Stagnant
Forest	Area of total forest	Decreasing
	Timber stock	Increasing
Biodiversity	Share of threatend wildlife	Improving
Fish	Share of aquaculture	Increasing

3. Environmental quality of life		
Subject	Indicators	Trend
Environmentally induced health problems	Population exposure to urban air pollution	Improving; improved greatly post-2008
	Urban green space per capita	Improving
Access to sewage treatment & drinking water	Population connected to sewage treatment	Improving
	Population with access to safe drinking water	Improving

4. Policy response & Economic opportunities		
Subject	Indicators	Trend
Green R&D	Government green R&D expenditure	Increasing; increased greatly post-2008
Green Technology	International patent applications	Increasing
Environmental industry	Environmental sector employment	Was decreasing, but began increasing since 2008
Green finance	Share of Green ODA	Increasing
Environmentally related tax & recovery cost	Share of environmentally related tax	Was decreasing, but increased in 2010
	Environmental protection expenditure	Increasing

SOURCE: Statistics Korea, *Korea's Green Growth, Based on OECD Green Growth indicators*, (Seoul, Kostat, 2012), accessed from <http://kostat.go.kr/koreasGreenGrowth/EBook.htm> on 10 November 2013

Despite these differences the two frameworks share important similarities. Almost half the indicators are common to both frameworks. The assessments based on the partially-overlapping sets of indicators lead to similar conclusions – indicating a positive performance, especially in relation to research and development and the share of environmental industry.

Based on the indicators, the commitment to green growth seems to have initiated a process of transformation towards a green economy, reflected in greener lifestyles and some decoupling of environmental pressures from GDP. But despite the positive assessments, there is evidence that still, growth may not lead to a greener future. The share of environmental taxation in government revenue, for instance, a decisive instrument in implementing green growth, is decreasing over the period assessed.

There is some decoupling of environmental impacts from economic growth with both environmental pressures and the size of the economy increasing, but environmental pressures rising at a slower rate than economic growth. Stocks of environmental assets are still declining: GHG emissions are increasing and forest areas are shrinking. The objective of environmental sustainability sometimes seems secondary, in comparison with growth and self-sufficiency in the assessment defined by Republic of Korea policy. The presence of indicators such as development of oil and gas supplies or the inclusion of coal gasification among new and renewable energy technologies, are in this regard symptomatic.

The outcome of Rio+20, *The future we want*, encourages “each country to consider the implementation of green economy policies in the context of sustainable development and poverty eradication, in a manner that endeavours to drive sustained, inclusive and equitable economic growth and job creation, particularly for women, youth and the poor”²².

However, both the OECD and the Republic of Korea's indicator sets of green growth indicators pay less ,

attention to different dimensions of inequality, financial stability, and other critical government objectives needed to support economic dynamism and long-term capacity of the economy (whether “brown” or “green”) to meet human needs.

The need for green growth indicators relevant to Asia-Pacific developing countries

Despite important advances in the international policy and scientific community on providing more comprehensive indicators of sustainable development and green growth, there is a need for strengthening the applicability of green growth indicators for developing countries.

Asian and Pacific developing countries have a strong interest in creating the same potential for growth and comparable material standards of living experienced in OECD countries. There is recognition, however, that economic development strategies in Asia and the Pacific must adapt to a context of natural resource supply constraints, higher prices and greater price volatility.

In addition many developing countries face a challenging socio-economic context including socio-economic vulnerability, persistent and widening inequalities, governance deficits and vulnerability to climate change. A green growth framework that is adapted to the needs of developing countries should address these dimensions of green growth.

A green growth indicator framework that reflects some of the environment and development challenges of the region should include, in addition to the shared concerns expressed in internationally-promoted indicator frameworks, issues of inclusiveness and equity regarding access to the benefits provided by nature, and inequity related to the burdens of environmental degradation.

In addition, they should pay close attention to the institutional environment that frames the incentives for economic actors to better inform integrated policies across different policy domains relevant to environmentally sustainable and equitable economic growth. A more explicit focus on setting limits and targets regarding natural resource use and emissions would reflect the urgent need to respect planetary limits.

The example of the Republic of Korea shows that it is important that green growth indicator frameworks should also be directly relevant to the national green growth policy priorities as already expressed in many countries.

A review of high level green growth policy initiatives in other Asia-Pacific countries such as Indonesia, Mongolia, Kazakhstan, Thailand and Viet Nam shows that further effort is needed to identify a wider range of indicators that are potentially applicable to the needs of developing countries and their green growth policy priorities.

Green growth policy priorities expressed by these countries include: equity and inclusiveness; green investments and financing; access to basic services; human capital investments (including culture and heritage, and traditional knowledge); urbanization patterns and infrastructure development; governance (transparency, accountability and inclusiveness); human development; resilience; and green growth as it relates to specific sectors (including, in particular, agriculture). Indicator frameworks for green growth should take these policy perspectives into consideration.

General considerations for green growth indicators

More generally, defining and designing strategies for a green economy requires information and indicators that are conceptually sound, help raise awareness in the policy community and beyond, enable government agencies to inform policy statements and set targets, and monitor policy success and progress.

Green growth indicators must be policy relevant, and ideally assist in defining key performance indicators that assess the impact of government spending against defined policy or programme objectives. Achieving

sustainable development depends on strong alignment of economic policy and sustainability-related key performance indicators. Indicators should be easy to interpret, apply international standards, and able to be established by national statistical agencies in developing countries.

Compatibility with the System of National Accounts is an important condition to ensure compatibility with economic indicators and to raise the acceptability of broader concerns in economic policy agencies. Important opportunities for ensuring compatibility are presented by the adoption of the United Nations System of Environmental and Economic Accounts (SEEA) as an international statistical standard by the United Nations Statistical Commission at its forty-third session in 2012.

Because of their various roles in the policy cycle, in terms of awareness raising, informing policy targets and use as a basis for assessing progress and policy effectiveness, indicators frameworks should be understood as flexible and adaptable to different contexts and users. The indicators should allow for disaggregation by sector, or by geographic or political regions.

At the same time, a useful framework should provide a limited number of headline indicators that can be compared across countries to enable benchmarking and for easy assessment of progress of green growth policy initiatives in different countries.

Quality of growth and green growth – a conceptual framework for indicator development

ESCAP's work on green growth since 2005 has emphasized that green growth, or building a green economy in the context of sustainable development and poverty eradication, can only be achieved through "systemic" change. Improving the efficiency of existing systems of provision will be an important condition but is not sufficient to achieve sustainable development in Asia and the Pacific.

In many areas a transition to new systems of provision that enable high human development at much lower environmental and resource use costs will need to be enabled through policy and institutional support, including economic instruments that enable and guide substantial processes of social and economic change. This may include redirecting investments to green economic activities and green infrastructure and changes in budgeting and taxation that increase the cost of natural resources while reducing the cost of labour to foster employment creation and enable greater resource productivity.

ESCAP's Low Carbon Green Growth Roadmap for Asia and the Pacific²³ identifies specific policy options to enable systemic change and transition to a green economy. The Roadmap presents fact sheets, policy papers and case studies that illustrate how a sustainability transition can be achieved in practical terms.

A key transformation advocated by the Roadmap is a shift from a focus on quantity of growth to quality of growth. Three dimensions of quality of growth are described: ecological quality, economic quality and social quality, which relate strongly to the three dimensions of sustainable development through the essential capital assets that form a society's productive base and underpin human well-being, namely natural capital, manufactured capital, and human capital.

ESCAP's work on quality of growth underlines that sustainable development relies on transforming a "vicious cycle" of economic growth based on exploitation of natural and human capital into a "virtuous cycle" of high quality of growth driven by investment in people and the resources of the planet.

A conceptual framework for quality of growth proposed by ESCAP²⁴ can assist policy makers and practitioners to evaluate existing economic development strategies, to identify trade-offs and potential synergies, based on the determinants of an economic growth pathway that achieves sustainable development outcomes.

As presented and described in full in a separate publication,²⁵ and as shown in Annex 2, a conceptual framework for quality of growth identifies five determinants of a good quality of growth relevant to developing countries. The five key determinants identified are:

- Equity and access
- Structural transformation
- Efficiency and productivity
- Balancing capital investments
- Recognizing limits – in the economic, social and environmental spheres.

Each of the five determinants is discussed in relation to each of the three dimensions of quality of growth – environmental, social and economic (see Annex 2). This approach underlines that firstly, all forms of capital must be taken into account for a good quality of growth and secondly, that the trade-offs between the policy objectives in the economic, social and dimensions must be addressed – through policy, market and institutional interventions, but also through rethinking basic economic theory. The framework also highlights the need for an effective governance framework, i.e. institutional and policy support that is needed to promote each of the five determinants of a good quality of growth.

The possibility of identifying specific indicators for each dimension of growth and its determinants is explored in a separate publication (forthcoming) which proposes indicators and assesses their data availability and other aspects of feasibility.

Green growth indicators – a proposal

Placing green growth strategies in a wider concept of quality of growth provides a focus on “growth” that is appropriate for developing countries. The quality of growth framework also explicitly addresses green growth policy demands (such as inclusiveness and governance) identified by member countries and described above, and so also complements the approaches of other frameworks.

Adapting the framework for quality of growth to focus on the environmental context helps to define indicators that can help policymakers to assess progress on green growth. Consistent with the understanding that green growth is described by the environmental dimension of the quality of growth framework (including the necessary policy and institutional support) green growth strategies should be focused on promoting the capacity of the economy to meet the needs of its people in an inclusive, eco-efficient way and to boost productivity in increasingly diverse, low-carbon and resource-efficient economic activities that secure jobs. It also provides that natural capital stocks would not be undermined by enhancements in human well-being and GDP, and that environmental pressures (such as emissions and waste) would not exceed the capacity of the ecosystems to absorb them (see Box 1).

Box 1: A safe operating space for humanity

In 2009, a group of scientists led by Johan Rockström from the Stockholm Resilience Centre proposed a framework of ‘planetary boundaries’ designed to define a ‘safe operating space for humanity’.

This framework is based on scientific research that indicates that since the Industrial Revolution, human actions have gradually become the main driver of global environmental change. The scientists assert that once human activity has passed certain thresholds or tipping points, defined as ‘planetary boundaries’, there is a risk of ‘irreversible and abrupt environmental change’. A total of nine boundaries are identified: climate change, rate of biodiversity loss, biogeochemical flows (both nitrogen and phosphorus), stratospheric ozone depletion, ocean acidification, global freshwater use, change in land use, atmospheric aerosol loading and chemical pollution.

The scientists estimate that human activity appears to have already transgressed the boundaries associated with climate change, rate of biodiversity loss and changes to the global nitrogen cycle. Further findings suggest that humanity may soon be approaching the boundaries for interference with the global phosphorous cycle, global freshwater use, ocean acidification and global change in land use. The scientists suggest that the boundaries are strongly interlinked, so that crossing one may shift others and even cause them to be overstepped. While the scientists themselves stressed that their assessments were only initial estimates, their work represents an important shift towards more systematic monitoring of humanity’s impact on its environment.

SOURCE: The Stockholm Resilience Centre in United Nations, (2012), “Resilient People, Resilient Planet: A future worth choosing”, “The report of the United Nations Secretary-General’s High-level Panel on Global Sustainability”.

Green growth indicators should help policymakers to answer the following questions relating to the environmental dimensions of quality of growth:

► **Equitable distribution and access:** To what extent is economic growth providing equitable access to resources, and ensuring that basic needs in relation to environmental resources are met? To what extent do governance structures support equitable access to the benefits of nature and also sharing of burdens of environmental degradation?

► **Structural transformation:** To what extent is economic growth promoting structural transformation in favour of building a green economy – and if so, how quickly is this happening? How is productive capacity changing and how quickly are green and decent jobs being created? To what extent are fiscal policy, investment, human capital formation and other policies supporting structural transformation towards green sectors?

► **Eco-efficiency:** How efficiently are consumption and production activities using energy and other resources, and to what extent are growth strategies promoting decoupling of economic growth from environmental pressures? To what extent are policies and institutions supporting eco-efficiency?

► **Investment in natural capital:** How are stocks and flows of natural capital changing? – in particular the aspects of natural capital that are critical for socio-economic progress and which may be at risk.

► **Planetary limits:** Which natural resources are important yet constrained, or nearing critical thresholds? What are the economic, social and environmental risks related to natural resource use? What limits should be set on natural resource use and to what extent are the key resource use (and emissions and waste) limits and targets defined in policy?

The above framework and questions support the formulation of a list of indicators that may be adapted at the national level. It covers both the environmental and governance dimensions (see table 1).

It should be noted that in some cases, there is low possibility of defining objective or quantitative indicators and overall progress will need to be determined based on both objective and subjective (qualitative) assessments – including through surveys.

While the indicators are defined for use at the national level, they can also be adapted to specific sectors of the economy – in particular those related to structural transformation and eco-efficiency.

With respect to the dimension of planetary boundaries, scientific research on identifying ecosystems at risk and the criticality of the services provided by nature to a particular economy and society should inform policies and regulations that set limits/targets on natural resources use. Examples of such limits include the minimum forest cover targets that have been set by the Government of Bhutan, or the targets related to slowing or reducing carbon emissions that have been set by some developing countries.

Effective dialogue at the science-policy interface and an inclusive process of engaging stakeholders would be important to facilitate a process of defining limits on natural resource use and emissions/waste that are socially-acceptable but which are informed by credible science.

A prominent example of such a science-policy interface is provided by the deliberations of the United Nations Framework Convention on Climate Change which bases its decisions on the recommendations of the Intergovernmental Panel on Climate Change. These types of limits and targets are relevant at local, national, subregional and regional levels.

TABLE 1: Proposed green growth indicators

Equitable distribution and access	Distribution of benefits from resource, energy, ecosystem services, and distribution of burden of degradation	<ul style="list-style-type: none"> • Access to water • Domestic water use per capita (relative to basic requirement) • Food security • Access to energy • Environmental footprints (energy, carbon, materials and water) • Access to clean air (air quality) • Water quality • Access to land
	Institutional and policy support for inclusion and participation	<ul style="list-style-type: none"> • Access to environmental information, participation in decision-making, and access to environmental justice • Policies for distribution/use of income/taxes from natural resource use • Environmental impact assessment policy • Access to land and land rights • Policies related to traditional and indigenous land rights • Public disclosure policy for extractive industry, other environmentally sensitive sectors • Participation in decision-making (e.g. the Human Rights Index, School for a Culture of Peace) • Human rights (e.g. Human Rights Index)
Structural transformation	“Green” investment, investment in environmental goods and services	<ul style="list-style-type: none"> • Production of environmental goods and services (absolute; share of overall investment, rate of change) • Value-added contributed by green sectors to total GDP (absolute; share; rates of change) • Sustainable public procurement (absolute; share; rates of change) • Trade in environmental goods and services (absolute; share; rates of change) • Certified organic production (absolute; share; rates of change) • Green jobs (absolute; share; rates of change) • Renewable energy use (absolute; share; rates of change) • Buildings meeting “green” standards • GHG emissions and resource use per worker (absolute and rates of change) • Resource consumption (material footprint)
	Institutional and policy support for social, technology and other innovation	<ul style="list-style-type: none"> • Financial incentives for green investment • Sustainable public procurement policy • Extended producer responsibility policy • Investment in green research and development • Investment in green education and training • Investment in environmentally sound technologies
Eco-efficiency	Resource / waste / emissions intensity / efficiency	<ul style="list-style-type: none"> • Resource efficiency: Materials and energy intensity of consumption and production, and decoupling rates (index) • GHG intensity of consumption and production , and decoupling rates (index) • Materials use per production unit, per household/capita (absolute; rates of change) • Waste generation per production unit, per household/capita (absolute; rates of change) • Water and energy use , per production unit, per household/capita (absolute; rates of change) • Waste recycling rates (absolute; rates of change) • Renewable energy share (absolute; rates of change) • Energy used per passenger km (and other infrastructure related efficiency indicators)

	Institutional and policy support for efficiency/productivity improvement	<ul style="list-style-type: none"> • Resource pricing policy (water, electricity/energy) • Resource taxation policy (taxing resources at source) and revenues from environmentally-related taxes (absolute; share of total; rates of change) • Polluter pays policy • Cost savings from energy and resource savings • Support by cleaner production centres • Government schemes for saving resources • Subsidies for primary resource sectors and households (coal, gasoline) (absolute; share of government spending; rates of change) • Carbon pricing (cap and trade) and taxes • Information disclosure policy and schemes, including eco-labelling schemes • Corporate social responsibility incentives and policy
Investment in natural capital	Natural capital stocks and natural resource flows	<p>Stocks</p> <ul style="list-style-type: none"> • Mineral, energy, land, soil, timber, aquatic, other biological and water resources (cultivated and natural) <p>Flows</p> <ul style="list-style-type: none"> • Material use (domestic material consumption) • Energy use (total primary energy supply) • Water use (total water use) • Land use (land in production) • GHG emissions and other air pollutants (total territorial emissions) • Residential and industrial waste
	Institutional and policy support for investment in natural capital	<ul style="list-style-type: none"> • Recognition of ecosystem services in law • Policy and institutional support for payments for ecosystem services • Progressive and pro-environmental tax and other policy to address market externalities (internalization of true cost of common pool resources)
Planetary limits	Policy re: resource use and emissions limits and targets at regional, subregional, national, and/or sub-national levels	<p>Renewable resources</p> <ul style="list-style-type: none"> • Minimum primary forest area coverage • Area of undisturbed natural ecosystems • Minimum area to be set aside for biodiversity protection • Maximum water use relative to available water (Falkenmark Water Stress Index) <p>Non-renewable resources</p> <ul style="list-style-type: none"> • Maximum material, energy use <p>Waste and emissions</p> <ul style="list-style-type: none"> • Targets re: greenhouse gas emissions, other emissions
	Institutional and policy support for science-policy interface and stakeholder involvement in setting limits and targets, monitoring and feedback mechanisms	<ul style="list-style-type: none"> • Evidence of specific institutional mechanisms and policies requiring evidence and science-based policymaking • Evidence of specific institutional mechanisms and policies requiring stakeholder participation on setting targets and limits

Looking forward – key steps

The adoption of the United Nations System of Environmental and Economic Accounts (SEEA) as an international statistical standard by the United Nations Statistical Commission at its forty-third session in 2012 is an important step towards the development of sustainable development indicators and, more specifically, green growth indicators – bringing statistics on the environment and its relationship to the economy to the core of official statistics.

The SEEA Central Framework is a multipurpose, conceptual framework that describes the interactions between the economy and the environment, and the stocks and changes in stocks of environmental assets.

In filling one of the most important shortcomings of the System of National Accounts, the SEEA provides the necessary basis from which to derive green growth indicators.

The SEEA provides a common international statistical framework with definitions, classifications – such as for the environmental goods and services sector. It also facilitates the identification of environmental indicators that can support economic modelling and as a consequence increasing relevance for policy makers and users in general. Advanced initiatives on green growth indicators have already used the framework to develop sophisticated approaches to assessing progress.

There are other important developments that can further developing country efforts on assessing green growth. Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) has, in collaboration with UNEP, developed a regional database on Material Flows Accounts (a sub-component of SEEA) which is already used in publications and available online.²⁶

Several countries have initiated the establishment of environmental satellite accounts and are exploring establishing sub-accounts of the SEEA standard, depending on their specific circumstances. These initiatives present opportunities for capacity building. New opportunities to better understand which jobs and sectors can be considered green are provided by the SEEA framework and International Labour Organization research, as well as national research in countries like the Republic of Korea.²⁷

The choice of indicators should be directly informed by a clear understanding of the social contexts, and the environmental challenges and the economic opportunities and should be directly relevant to national policy frameworks. The development of headline indicators for each dimension would support communication and outreach, and complement the “dashboard” approach.

A process of inclusive social dialogue supported by credible scientific research can help to prioritize critical environmental assets, vulnerable and deprived sectors of the population, as well as opportunities for green growth.

Learning from the past, it is important to avoid adopting indicators that are not easily used for policy analysis or as key performance indicators for governments. Indicators should be reflected in decision-making tools and linked with economic modelling efforts. Governance indicators, which currently depend heavily on qualitative data require specific support for further development, including stakeholder participation for defining assessment approaches.

Finally, the “wish-list” of indicators should be fully assessed for feasibility – using agreed frameworks that can be specially adapted, such as the RACER (Relevant, Accepted, Credible, Easy and Robust) framework applied by the European Commission to assess the value of scientific tools for use in policy making.²⁸

The results of such feasibility assessments can inform decisions by governments and other stakeholders on whether to invest in data collection and assist in further refining indicators which may be critical for assessing progress, but which are not yet available. An assessment of quality of growth indicators, including green growth indicators, is the subject of a forthcoming publication.

ANNEX 1: Examples of green growth indicators – efficiency and transformation

Decoupling and efficiency indicators

		Supply side environmental productivity indicators	Demand side environmental productivity indicators	Remark
UNEMG	Decoupling & Efficiency	Materials use (per \$US GDP) Waste generation (per \$US GDP) Energy use (per \$US GDP) Water use (per \$US GDP) Land use (per \$US GDP) Ecosystem change (per \$US GDP) Hazardous substances (per \$US GDP)		Propose the indicators economy wide or broken down per sector Agriculture, buildings, cities, energy, forests, fisheries, ICT, manufacturing, tourism, transport, waste, water They also propose the Genuine Progress Indicator which can be considered as a measure of the efficiency of the economy to use resources to produce well-being
UNEP	Indicators for environmental issues and targets (1)	Resource efficiency Energy productivity (Btu/\$US) Material productivity (ton/\$US) Water productivity (m ³ /\$US) CO ₂ productivity (ton/\$US)		In UNEP's framework resource efficiency indicators constitute a sub-component of a larger category including indicators of the state of the environment and environmental pressures (here included in Sustainable Development indicators category)
OECD	Environmental and resource productivity	Carbon and energy productivity Resource productivity: materials, nutrients, water Multi-factor productivity	Demand-based environmental services	Includes a measure of multi-factor productivity In a section dedicated to the socio-economic context the framework also includes a measure of labour productivity
European Union		Resource Productivity (GDP/Domestic Consumption expressed in euro/tonne) Water (water exploitation index %) -Land (artificial land km ²) -Carbon (GHG) emissions (tonnes) -Natural ecological capital (Ecosystem Degradation under development by the EEA)	-Environmental impacts of resource use (life cycle based resource efficiency indicators) -Embodied land for agricultural and forestry products (km ²) -Water footprint or embodied water -Carbon footprint	The Commission will use a lead indicator (resource productivity), accompanied by a dashboard of complementary macro indicators. A complementary set of theme specific indicators will be used to measure progress towards the specific thematic objectives and actions set out in the roadmap
	Sustainable growth	Energy efficiency (with a 20% improvement target by 2020)		The EU has a strategy of smart sustainable and inclusive growth, at the Union level the only headline indicator of eco-efficiency is energy efficiency

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Green transformation, economic opportunities and policy responses indicators

		Green investments, jobs, and sectors	Drivers of economic technical transition	Market signals and regulatory instruments	Remarks
UNEMG	Green transformation of key sectors of economy	Investment (\$) Employment (jobs) Output (\$)			<p>The concept of a green economy focuses on investment and entails an increasing share of green sectors or activities. This could be assessed with economic indicators of these activities: investment, value added, output and employment. The environmental goods and services sector (EGSS)²⁹ can provide a starting point for this disaggregation within the System of National Accounts (SNA)³⁰. Definition of "Green": technologies, goods and services that have been produced for environmental purpose (must be the "main purpose") The concept of a green economy focuses on investment and entails an increasing share of green sectors or activities. This could be assessed with economic indicators of these activities: investment, value added, output and employment. The environmental goods and services sector (EGSS)³¹ can provide a starting point for this disaggregation within the System of National Accounts (SNA)³². Definition of "Green": technologies, goods and services that have been <i>produced for</i> environmental purpose (must be the "main purpose") Priority sectors: Agriculture, Buildings, Cities, Energy, Forests, Fisheries, ICT, Manufacturing, Tourism, Transport, Waste and Water³³³⁴</p>
UNEP	Indicators for green economy policy interventions	Green investment (1) EGSS investments (\$US/year) Green procurement Expenditure in sustainable procurement (\$US/year and %) CO ₂ and material productivity of government's operations	Green investment (2) R&D investment (% GDP) Green job skill training Training expenditures Number of people trained	Green fiscal reform Fossil fuels, water and fishery subsidies (USD or %) Fossil fuel taxation (USD or %) Renewable energy incentive (USD or %) Pricing externalities and valuing ecosystem service Carbon price (USD/ton) Value of ecosystem services (eg: water provision)	
OECD	Economic opportunities and policy responses	Environmental goods & services "green industries", trade in "green products" and creation of "green jobs" International financial flows	Skills and training Technology and innovation Green innovation indicators + general innovation indicators Management approaches	Prices and transfers Regulations	

		Green investments, jobs, and sectors	Drivers of economic technical transition	Market signals and regulatory instruments	Remarks
European Union	Grow Green	Strengthening market functioning and competitiveness Clean and efficient energy sector -Share of renewable energy in total energy Consumption Sustainable use of resources -% of Municipal waste recycled, composted or incinerated with energy recovery measures -Final energy consumption of transport / GDP Markets for green products -Eco-label awards -Share of eco-products in all exports of goods	Boosting new sources of growth Green human capital -Share of environment related employment -GHG emissions per worker -Urban population exposure to air pollution Green technological progress -Green patents -Effects of innovation on material and energy Efficiency -Change in average CO ₂ emissions from new cars sold	Environmental tax reform and fiscal consolidation Revenues side -Pollution & resources taxes / GDP -Share of GHG emissions covered by ETS Expenditures side -Green public procurement	The few indicators presented are example taken from the 90 indicators of the 'Igrow green' database
	Resource efficient Europe	Improving products and changing consumption patterns -Green Public Procurement (GPP) -Number and value of green products purchased by households output or share of green products in total output Turning waste into a resource -Overall recycling rate; -Proportion of secondary raw material used in the EU economy compared to primary raw material	Supporting research and innovation -Number and value of funding (€/year) of research and innovation projects promoting mainly resource efficiency and sustainable environmental management, allocated through European financial support programmes Boosting efficient production -Proportion of companies using environmental footprint, by sector and size class, within priority sectors -Number of known 'substances of very high concern' (SVHC)	Getting the prices right -Environmental taxes as share of total taxes and social contributions; -Total value of environmental taxes paid. -Phasing out inefficient subsidies -Annual value of all EHS provided	

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ANNEX 2: Framework for quality of growth

Figure 3: A conceptual framework for quality of growth

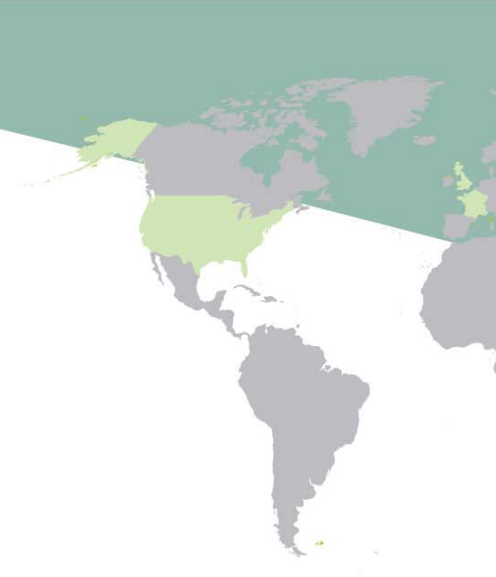
	Dimensions of sustainable development			Governance (Institutional and policy enablers)
	Economic	Environmental	Social	
Distribution – equity and access	Distribution of economic gains (wages, income equality, consumption, employment and livelihoods)	Distribution of benefits from natural resources through products (indirectly) or ecosystems services (directly), sharing the burden of degradation and pollution	Access to opportunity and distribution of human capital (education, health-care, mobility, basic needs and infrastructure, participation, social protection)	Institutional and policy support for inclusion, opportunity and participation (multi-sectoral integration and coordination, government investment in public goods, enforcement of rights to development, rule of law, access to information, participation and justice, inclusiveness of policies related to natural resource use)
Efficiency & productivity	Total factor productivity, manufactured capital productivity	Efficient resource use, low resource, waste and emission intensity	Labour productivity enhancement through human capital investment and decent work	Institutional and policy support for multi-sectoral integration and coordination; governance efficiency and for efficiency/productivity improvement
Structural Transformation	Moving from low-value added to high-value added, economic diversification and complexity, job creation	Moving from high resource and emissions intensity sectors to lower resource and emissions intensity sectors, using resources effectively and efficiently (green investments, production of environmental goods and services, green jobs)	Investment in social and human capital formation (Networks, R&D, knowledge, skills and physical and emotional health)	Institutional and policy support for multi-sectoral integration and coordination; social, technology and other innovation; and adaptive governance, including stakeholder participation and monitoring and feedback mechanisms
Balancing capital investment	Investment in Manufactured (factories, machinery, infrastructure)	Investment in Natural capital (non-renewable and renewable endowments)	Investment in human capital (investment in social capital, education, life expectancy and general well-being and related outcomes)	Institutional and policy support for multi-sectoral integration and coordination; and balanced capital investment (including internalization of social and environmental values)
Recognizing limits	Policy targets and limits related to Ability to pay in the long-run (debt, inflation), or financial (capital) limits to growth or market failure	Policy targets and limits related to planetary limit - Resource resource depletion (scarcity) and overuse of absorptive capacity of ecosystems (degradation) – global environmental change or environmental limits to growth	Policy targets and limits related to human well-being (e.g. poverty reduction, millennium development goals etc.)	Institutional and policy support for multi-sectoral integration and coordination; strong science-policy interface and stakeholder involvement in policy-making

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The green areas of the map represent the members and associate members of ESCAP

ESCAP is the regional development arm of the United Nations and serves as the main economic and social development centre for the United Nations in Asia and the Pacific. Its mandate is to foster cooperation between its 53 members and 9 associate members. ESCAP provides the strategic link between global and country-level programmes and issues. It supports Governments of the region in consolidating regional positions and advocates regional approaches to meeting the region's unique socio-economic challenges in a globalizing world. The ESCAP head office is located in Bangkok, Thailand, with subregional offices in Almaty, Kazakhstan; Incheon, Republic of Korea; New Delhi, India; and Suva, Fiji. Please visit our website at <www.unescap.org> and <www.greengrowth.org> for further information.



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