Executive Summary

Developing and implementing framework conditions that promote green growth requires a good understanding of the determinants of green growth and of related trade-offs or synergies. It also requires appropriate information to support policy analysis and to monitor progress.

For convenience, the ***definition*** used in this report is repeated here:

> Green growth is about fostering economic growth and development while ensuring that the natural assets continue to provide the resources and environmental services on which our well-being relies. To do this it must catalyse investment and innovation which will underpin sustained growth and give rise to new economic opportunities.

Green growth has thus several dimensions, 'greening growth' and harnessing new growth possibilities from environmental considerations. By its very nature, such a process is not easily captured by a single indicator, and a ***small set*** of measures will be needed. The ambition is ***pragmatic***: green growth indicators are seen as markers or milestones on a path of greening growth and of seizing new economic opportunities.

The set of green growth indicators listed below is a starting point rather than a final list and will be further elaborated as new data become available and as concepts evolve. Indeed, a central conclusion from the work on indicators is the measurement agenda that is drawn up at the end of the section. It provides the way forward towards addressing the most pressing data ***development needs*** in the area.

Measurement framework

A natural starting point for defining green growth indicators is the ***sphere of production*** where economic inputs are transformed into economic outputs (goods and services). A direct source of economic growth is therefore the growth of ***inputs***, in particular labour, produced capital such as machines, and intermediate inputs that are used up in production such as steel in the automobile industry. But production also uses ***services from natural assets***, either in the form of natural resource inputs into production (these may be non-renewable such as minerals extracted from the ground or renewable such as fish stocks) or in the form of disposal services where the natural environment provides services as a sink for pollutants and residuals emitted during production. Services from natural assets are rarely quantified in economic models and accounting frameworks and yet they are central to examining the greening of growth.

A ***first group*** of indicators is therefore ***environmental and resource productivity***, representing the volume of output per unit of services from natural assets. Rising environmental and resource productivity would appear to be a necessary condition for green growth.

Changes in environmental and resource productivity can reflect several effects, including substitution processes between natural assets and other inputs, shifts in industry composition or overall, 'multi-factor' productivity change. In a first instance, it will not be able to empirically distinguish between these effects but such work figures prominently on the measurement agenda. Some care must therefore be taken when interpreting partial productivity measures although the caveats relating to environmental productivity are not different from those relating for instance to labour productivity. But environmental and resource productivity indicators would appear useful nonetheless. The choice of specific indicators in this area was governed by the idea of capturing ***key aspects of a low-carbon, resource-efficient economy***. As these indicators deal with the production side of the economy, growth has been captured by GDP.

It is also of interest to introduce the notion of ***demand-based environmental services***, i.e., those flows of environmental services or emissions that are induced by domestic final demand but not necessarily by domestic production. In the case of emissions, this 'footprint' approach tracks the emissions embodied in imports, adds them to direct emissions from domestic production and subtracts the emission contents of exports. The resulting figure informs about the direct and indirect contents of environmental services in domestic final demand – essentially consumption of households, governments and investment.

The production perspective outlined above is not sufficient to monitor the transition towards green growth. For sustained growth, the asset base has to be kept intact. One reason is that ***a declining asset base constitutes a risk to growth*** and such risks should be avoided. 'Asset base' should be understood in a comprehensive way, encompassing produced as well as non-produced assets, and including in particular environmental assets and natural resources. Broader concepts such as sustainable development would also include human capital or social capital. For purposes of the green growth strategy, however, the focus will remain on ***economic and natural assets***. Loosely speaking, 'keeping the asset base intact' implies that net investment is positive – more needs to be added to the asset base in the form of investment or natural regeneration than is subtracted though depreciation or depletion. Whether a particular growth path of consumption or income can be sustained depends also on expected rates of multi-factor productivity change, thus adding to the central role that innovation and technical change play in considerations about green growth.

A major question is how easily one type of asset can be substituted for another asset, i.e., if the decline in one type of asset can be made up for by an increase in another type of asset. In a world of perfect measurement and perfect markets, this information should be contained in asset prices, reflecting society's preferences and vision of the future. Absent such prices for most assets, measurement has to start with ***monitoring the physical evolution of natural assets*** and this constitutes the ***second group*** of indicators. Over time, measurement efforts should be undertaken to advance on the valuation of (net investment) in at least some important natural assets. This has been reflected in the measurement agenda.

Considerations about keeping society's asset base intact relate directly to one dimension of the quality of life that is relevant for the work at hand, namely the direct impact of the environment on people. Environmental outcomes are important determinants of health status and wellbeing more generally. They provide an example where production and income growth may not be accompanied by a rise in overall well-being. For instance, air pollution, in particular exposure to particulate matter, is much higher in some of the emerging economies than across the OECD countries. In addition, a larger share of the population lives under medium to severe water stress, while low levels of wastewater treatment and pollution contribute to the incidence of waterborne and preventable diseases. The ***third group*** of indicators thus deals with the ***environmental quality of life***.

A ***fourth*** aspect is the ***opportunities arising from environmental considerations.*** One way of framing relevant indicators is by examining the role of 'green industries', trade in 'green products' and creation of 'green jobs'. While widely discussed, closer inspection of these concepts shows that they are often difficult to pin down statistically. There is a more basic question whether the potential for green growth is adequately captured by measuring the output and jobs of those companies that produce environmentally related goods, services and technologies. For instance, an economy could move towards a low carbon growth path if traditional industries (say mining or steel production) increase their energy efficiency through new modes of organisation – process innovation – or if there is product innovation that leads to products that are less energy intensive in their use, triggered by cost or competitiveness considerations rather than environmental concerns. Thus, the production of environmental goods, services and technologies is only *one* aspect of the potential for green growth.

Another central aspect in the context of economic opportunities is ***innovation and technology***. These are drivers of multi factor productivity change through new products, entrepreneurship and business models, and new consumption patterns. General innovation has to be distinguished from green innovation. The latter mainly relates to environmentally-related research and development and technologies. Thus, akin to 'green industries', looking at 'green innovation' will only tell part of the story that innovation at large plays in the transition to green growth. A trade-off arises from the perspective of constructing green growth indicators. Focusing on green innovation indicators does not do justice to the full importance of innovation, but general indicators of innovation are not very helpful in monitoring society's responses to the green growth challenge. The work at hand covers both aspects.

Clear and stable ***market signals*** are key to affecting the behaviour of producers and consumers. 'Getting the prices right' has to be one of the major policy concerns when producers and consumers cause negative externalities to the environment through their economic activity. Several of the policy response indicators relate to ***environmental taxes and transfers***.

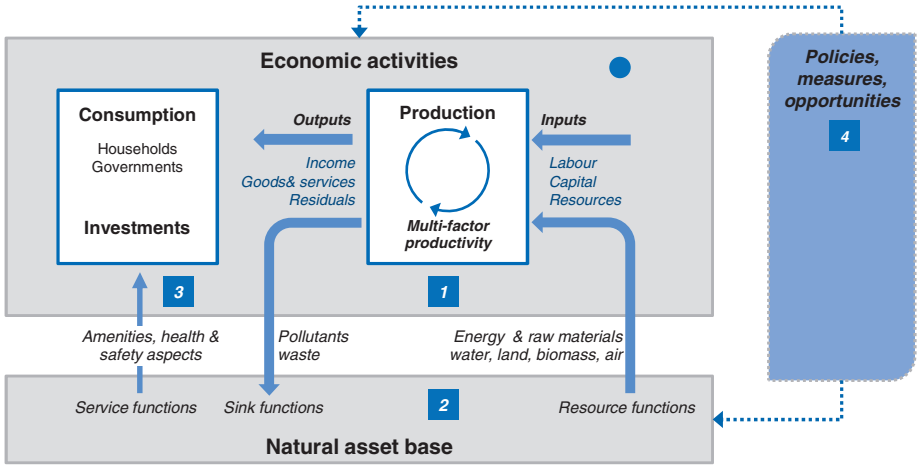
Regulatory instruments should not be forgotten as a tool to reduce negative effects on the environment. Constructing indicators of regulation is tricky, however, as the information is often of a qualitative nature and hard to compare across countries. No results are shown here but the point has been marked in the measurement agenda.

Proposed indicators

The measurement framework thus explores four inter-related groups of indicators:

1. indicators monitoring the environmental and resource productivity of production and consumption;
2. indicators describing the natural asset base;
3. indicators monitoring the environmental dimension of quality of life, and
4. indicators describing policy responses and economic opportunities.

They are complemented with generic indicators describing the socio-economic context and characteristics of growth.



A preliminary selection of indicators was made on the basis of existing work in the OECD, other international organisations, and in member and partner countries. The indicators were selected according to their policy relevance, analytical soundness, and measurability, and structured in line with the measurement framework. The proposed set is thought to be neither exhaustive nor final. It has been kept flexible enough so that countries can adapt it to different national contexts.

Indicator groups and topics covered

1 The environmental and resource productivity of the economy	• Carbon and energy productivity • Resource productivity: materials, nutrients, water • Multi-factor productivity
2 The natural asset base	• Renewable stocks: water, forest, fish resources • Non-renewable stocks: mineral resources • Biodiversity and ecosystems
3 The environmental dimension of quality of life	• Environmental health and risks • Environmental services and amenities
4 Economic opportunities and policy responses	• Technology and innovation • Environmental goods & services • International financial flows • Prices and transfers • Skills and training • Regulations and management approaches
Socio-economic context and characteristics of growth	• Economic growth and structure • Productivity and trade • Labour markets, education and income • Socio-demographic patterns

Measurement agenda

Measurement issues constrain the full and timely production of green growth indicators. While there is a substantive amount of economic and also environmental data, it is often difficult to combine them due to differences in classifications, terminology or timeliness. A first and crucial ingredient of the measurement agenda is thus to develop and populate a ***consistent environment-economy accounting framework***. The System of Environmental and Economic Accounting (SEEA) will provide such a framework. Measurement efforts should be placed within this framework so as to maximise consistency and international comparability.

Apart from the general usefulness of integrated statistics, the preliminary set of green growth indicators reveals important gaps in the information base. These areas should form part of a green growth measurement agenda, to be implemented over the coming years. In particular:

- There are significant gaps in environmental-economic data at the ***industry level***.
- There is a need to develop and improve the physical data for key stocks and flows of natural assets. Prominent examples are information on land and ***land use*** changes and ***non-energy mineral resources*** that often constitute critical inputs into production.
- Better physical data also helps improving ***material flow analyses***.
- Improved information on ***biodiversity***.
- Efforts should also be directed at developing ***monetary values*** reflecting prices and quantities for (changes in) key stocks and flows of natural assets. Such valuations, even if incomplete and imperfect are required for ***extended growth accounting*** models, more comprehensive balance sheets and for adjusted measures of real income.
- Periodic information to inform on how environmental concerns trigger ***innovation*** in companies should be developed.
- Thought should be given how indicators on economic instruments can be complemented by indicators on ***environmental regulation***.
- Improved measures are needed on both the objective and the subjective dimensions of ***quality of life***, in particular measures of environmentally induced health problems and related costs; and public perceptions.

The proposed set of indicators comprises about twenty-five indicators, not all of them are measurable today. The multi-dimensional nature of green growth requires a sufficient number of indicators to do justice to the various aspects of the issue at hand. But a large dashboard also carries the danger of losing a clear message that speaks to policy makers and helps communicating with the media and with citizens. It is proposed that ***a small set of 'headline' indicators*** be selected that are able to track central elements of the green growth concept and that are representative of a broader set of green growth issues. This is a task that still lies ahead and requires broad consultation and discussion because, inevitably, opinions on the most salient set of indicators will vary among stakeholders. The OECD stands ready to take this task forward.

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