INTEGRATING the THREE DIMENSIONS of SUSTAINABLE DEVELOPMENT

A framework and tools

Greening of Economic Growth Series

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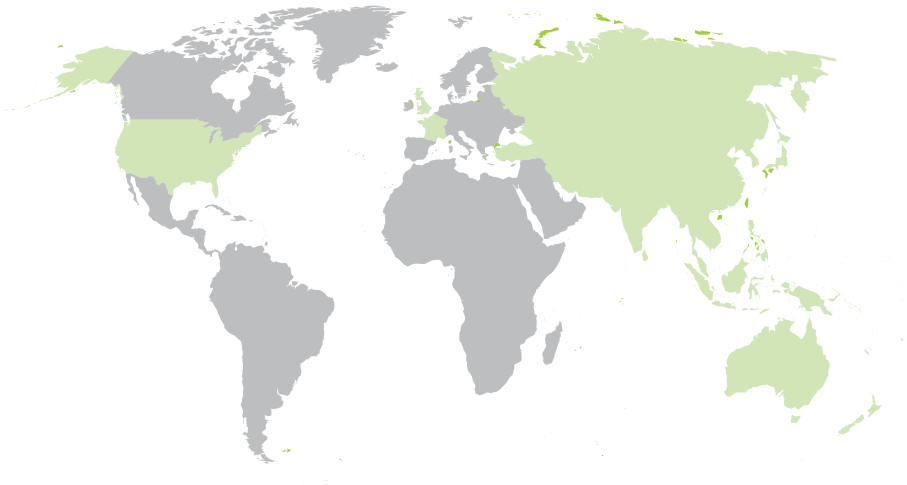

Greening of economic growth series

ESCAP, its partners and Asia-Pacific countries have advocated the "greening" of economic growth as a strategy to achieve sustainable development in the resource-constrained, high-poverty context of the Asian and the Pacific region.

The conventional "grow first, clean up later" approaches to economic growth are increasingly placing the futures of regional economies and societies at risk. The forward-thinking policymaker is tasked to promote development based on eco-efficient economic growth and at the same time, record more inclusive gains in human welfare and socio-economic progress. In order to assist policymakers in responding to such challenges, ESCAP's "Greening of economic growth" series provides quick access to easy-to-read guidance to specific policy approaches and tools.

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Contents

Abbreviations and acronyms

SDGs	Sustainable Development Goals.
ESCAP	Economic and Social Commission for Asia and the Pacific
GDP	gross domestic product
SNA	United Nations System of National Accounts

Executive summary

The United Nations General Assembly adopted the 2030 Agenda for Sustainable Development and 17 Sustainable Development Goals (SDGs) as a universal and transformative development strategy. The 2030 Agenda commits the global community to "achieving sustainable development in its three dimensions—economic, social and environmental—in a balanced and integrated manner".

Integration of the economic, social and environmental dimensions is key to achieving sustainable development. There is, in general, widespread acceptance of why the integration of these three dimensions is necessary; but there are also many questions as to "how" this integration is to be achieved. This publication was produced to assist policymakers in addressing the question of how to achieve integration across the policy cycle and to assess levels of integration.

Foundational concepts, such as systems thinking, are introduced to underline the interconnectedness between the three dimensions, the need for holistic thinking and the potential for "leverage points" for policy intervention.

The concept of multiple capitals is also introduced to highlight that integration of the three dimensions of sustainable development requires balanced investment in and across different forms of capital. Limiting the focus on only one or a few forms of capital, by assuming and accepting that there will be trade-offs, often leads to a decline and erosion in other forms of capital. Integration for sustainable development requires synergies between investments in the different forms of capital.

Two tools for integration are featured: Qualitative scenario building is a method and process that can support stakeholder learning, dialogue and social innovation by visualizing uncertain but possible futures. Scenarios provide narratives to describe what life in a particular region in the world might look like in 2030 if all the SDGs were to be achieved. This method is suitable for integrating the different dimensions of sustainable development because scenario storylines can explore interactions between them. It can also be used to describe pathways of action towards desired futures and ways of achieving such desired futures.

Input-output analysis is introduced as a quantitative and analytical framework suitable for linking the economic, social and environmental dimensions of investment, trade and related economic activity. It establishes links between resources and impacts associated with the use of resources from particular sectors or locations of production throughout the supply chain to the consumer of the final goods. In the context of global trade, it can expose the carbon, biodiversity and material footprints.

The concepts and tools introduced here are not exhaustive. This publication is only a first step towards meeting the needs of policymakers for frameworks and tools to integrate the three dimensions of sustainable development.

The guidance presented here benefited from inputs from experts in the Commonwealth Scientific and Industrial Research Organisation on qualitative scenario building and the Integrated Sustainability Analysis group at the University of Sydney on input-output analysis.

1. Introduction

Sustainable development requires balanced integration of economic, social and environmental dimensions. Integration of these three dimensions is an urgent shift in policy approach because of the widening income and other gaps in society and the breach of planetary boundaries, which places humanity increasingly at risk.[1]

The 2030 Agenda for Sustainable Development and its framework of 17 Sustainable Development Goals (SDGs) adopted by the United Nations General Assembly in September 2015 stress that eradicating poverty and ensuring that no one is left behind are priorities for the global community. The 2030 Agenda expresses the Member States' determination to "protect the planet from degradation, including through sustainable consumption and production, sustainably managing its natural resources and taking urgent action on climate change, so that it can support the needs of the present and future generations."

This publication is intended to assist policymakers in dealing with the challenges of balanced integration by providing an overview of useful concepts and practical tools that enable the merging of the three dimensions of sustainable development into the public policy cycle. This publication provides a general overview of one qualitative and one quantitative tool that can support many stages of the policy cycle—scenario building and input-output analysis, both of which are already used in various locations but have potential to be applied more widely in the region toward sustainable development.

2. Integration for sustainable development and the policy cycle

2.1 Integration of the three dimensions of sustainable development—New challenges for policymakers

The 2030 Agenda for Sustainable Development underlines a global commitment to "achieving sustainable development in its three dimensions—economic, social and environmental—in a balanced and integrated manner". Although there is global commitment to this integrated agenda for development, the "how" of integration has not been well defined nor communicated.

The work of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) emphasizes the need for four normative shifts in policy to promote integration:

- The basic conditions of social justice and ecological sustainability must become fundamental policy objectives rather than marginal objectives.
- There must be a shift from a predominantly short-term policy horizon to one that seeks long-term benefits for all.
- A focus on gross domestic product (GDP) as a measure of progress should be replaced by metrics that encompass the three dimensions of sustainable development.
- Public policy must recognize that the resources of the planet are not limitless and that resource constraints cannot always be addressed by technology.

These shifts seek to address some of the deficiencies in approaches to public policy framing that foster policy conflicts and trade-offs between the economic, social and environmental dimensions of development.

Where public policy either implicitly or explicitly prioritizes investments in economic activity without regard for the impact on the stocks of natural, human or social capital, negative externalities result, such as pollution, emissions, waste and social clashes. But policy responses to these phenomena that do not address the root causes of the policy conflicts and trade-offs ultimately will not support achievement of sustainable development.

Making these shifts in policy stance operational presents significant challenges to policymakers. They require reformed institutional frameworks, strengthened capacities, high-level political commitment and an inclusive and integrated vision of a sustainable future.

The commitment to integrating the economic, social and environmental dimensions of sustainable development into public policy also presents specific challenges at every stage of the policy cycle, as illustrated in Table 1.

TABLE 1. Stages of the public policy cycle and challenges to integration

STAGES	CHALLENGES TO INTEGRATION
Agenda setting	• How to ensure that human well-being results from economic progress and environmental protection? • How to capture and align the interests and perspectives of disparate interest groups? • How to set an agenda that is win-win for all population groups, as far as possible? • How to establish a shared vision for the future?
Policy formulation	• What are some of the hidden costs in economic, social and environmental terms? • Who should be involved in policy design? • What policy alternatives offer the strongest win-win synergies between economic, social and environmental perspectives in reasonable time scales? • What are the trade-offs, if any, and how can they be assessed and addressed by supplementary action?
Policy implementation	• Which specific areas (geographic, stakeholder group, sector or other) of investment will yield the most desirable policy outcomes?
Policy monitoring and evaluation	• How to monitor and track the economic, social and environmental dimensions of policy outcomes and impacts? • How to define and evaluate success?

By ESCAP's estimation,[2] the demands of an integrated development agenda on public policy will be tremendous:

- Policymakers must become adept at reconciling public and private interests.
- There must be enhanced capacity in governments to coordinate policies in different domains.
- Capacity to engage a diversity of stakeholders will become more and more critical.
- Governments will require strengthened capacity to analyse and evaluate various policy options, based on economic, social and environmental criteria, as well as to monitor progress and policy impacts.
- Policy frameworks must now achieve multiple objectives to support the needed shifts in policy stance, reshape market and other incentives, lengthen the time horizons and reduce policy uncertainty so that investments in people and the planet can work in tandem to drive a virtuous cycle of growth that continually invests in, rather than exploits, the basis for shared prosperity within the planetary limits.
- Policymakers must be able to identify where the trade-offs between different dimensions of sustainable development occur, what the root causes are and then design policies that foster synergies between the economic, social and environmental dimensions of sustainable development.

Governments are beginning to take on this challenge, such as New Zealand, which is using an integrated approach to measure the sustainability of its development (Box 1).

BOX 1. The use of an integrated approach to measuring sustainable development in New Zealand

New Zealand measures progress in economic, social and environmental domains using 16 indicators. These indicators aim to answer the following critical questions on sustainable development:

- Meeting needs—How well do we live?
- Fairness—How well are resources distributed?
- Efficiency—How efficiently are we using our resources?
- Preserving resources—What are we leaving behind for our children?

In 2007, the prime minister launched the Government's six sustainable development initiatives:

1. Helping households towards sustainability
2. Business partnerships for sustainability
3. Eco-verification: Demonstrating the sustainability of goods and services
4. Government to buy sustainable goods and services
5. Public service takes the lead in becoming carbon neutral
6. Towards zero waste

Source: New Zealand, Office of the Minister for the Environment, 2007. See also Statistics New Zealand.

New policy approaches and tools are needed to mainstream sustainable development and promote the integration of its three dimensions. Numerous concepts and tools are already available to help policymakers shift to more integrated approaches for policy development.

The concepts, such as systems thinking and multiple capitals, provide justification for using across the policy cycle the various tools that can help to expose and explore trade-offs between the different dimensions of sustainable development, reveal and explore the viewpoints of different stakeholders and assess the "wins" from synergizing policy objectives. The tools include multiple-criterion analysis that assesses policy based on different variables and integrated economic modelling, which incorporates environmental and social aspects.

This publication illustrates the potential for applying two such tools—one qualitative and one quantitative: (i) scenario building and (ii) input-output analysis.

2.2 Systems thinking as a foundation

The basic premise for integration is that the economic, social and environmental dimensions are interrelated and, for the most part, indivisible aspects of a whole system. People and the nature of the society in which they live are shaped by and, in turn, shape the economies that support their livelihoods and enhance their overall quality of life. Environments provide life-giving and economically important services to economies and to people.

Systems thinking enables a holistic approach to problem analysis and avoids looking at parts of a problem in isolation or taking a reductionist, linear thinking approach. By utilizing systems thinking as a lens through which to examine society, the environment and the economy, it is possible to handle greater levels of complexity and sophistication and use tools, such as system dynamics,[3] to construct potential scenarios of the future for analysis purposes.

In practical terms, systems thinking helps policymakers meet the challenges of an integrated development agenda by:

- improving the identification of stakeholders. A better understanding of how systems work and which parts of the system are crucial for change will help with understanding who should be targeted in public policy and which perspectives should be brought together.
- improving the areas of policy interventions through a better understanding of the root causes of issues that need to be addressed. Systems thinking helps clarify patterns of behaviour along with the

structures and systems that are driving them and ultimately the underlying mental models (attitudes, beliefs, morals, values and expectations) that design and maintain the structures and systems producing the results that need to be addressed through public policies.

- helping to determine "leverage points" of policy interventions through which a small change could lead to a larger shift in behaviours through a better understanding of a structure or system that produces these problems. Leverage points are also the places in a system that are the most critical points for intervention.

Systems thinking reveals interdependencies between different parts of a system, helping to identify the most influential driving forces shaping the system. It also enables the development of creative solutions.

Systems thinking is a growing discipline, based on the behaviour of feedback and complexity. The case of malaria eradication in Borneo Island (Box 2) provides an example in which systems thinking would have yielded better outcomes and saved resources.

BOX 2. Malaria eradication in Borneo Island

In the 1950s in Borneo Island, a malaria outbreak occurred. It was resolved by spraying DDT on residents' houses to kill the mosquitos. The DDT successfully killed the mosquitos, which carry the malaria parasite plasmodium, and malaria was contained. However, the DDT also killed the wasps that controlled the population of caterpillars that eat the roofs of houses. With the ensuing explosion of the caterpillar population, the roofs of people's houses started to collapse. The DDT that was sprayed also accumulated in other animals, including cats. With the demise of the island's cats soon after, the population of rats increased, resulting in plague and the destruction of people's grain stores.

This case illustrates how a solution needs to be thought through, taking into consideration the interconnectedness of various elements in a system and how they relate to each other and the possible unintended consequences of decisions and actions. If these elements in all dimensions—economic, social and environmental—are not fully taken into consideration, a solution to a problem can end up causing unexpected problems.

Source: O'Shaughnessy, P. T. , 2008.

2.3 Thinking in terms of multiple capitals

The notion of capital is central to economics, whereby capital stocks (assets) provide the flows of goods and services that contribute to human well-being.[4] A focus on economic growth means that manufactured capital tends to become the core focus and central asset and the most important indicator of a country's well-being. It is vital, however, that other forms of capital, especially natural capital, are taken into consideration when examining economic growth and progress. Recognition of multiple capitals ensures that the singular focus on investing in any one form of capital, for example, manufactured capital, does not erode the quality and assets of other capital, such as natural, financial, human or social capital.

A multiple capitals approach can help frame the thinking around opportunities for integration for sustainable development. In this approach, five forms of capital are defined: manufactured, natural, financial, human and social capital.

The Association of Chartered Certified Accountants, the global body for professional accountants, includes an additional form of capital: intellectual capital, due to the rise of the internet and internet companies, such as Google, Facebook, Wikipedia and others that predominantly leverage intellectual or knowledge capital.[5]

Balanced development through the recognition of the different forms of national wealth is at the heart of sustainability. Radej[6] provides an illustration of the application of the multiple capitals approach (Table 2). This approach entails an assessment of various aspects of a value-added growth strategy on different forms of capital to determine the specific indicators of capital formation (or erosion, for example). As the table

indicates, in summary, the overall impact on economic capital is highly positive, while the impacts on social capital are assessed as mixed.

TABLE 2. The application of a multiple capitals approach to assess the impact of a "value added growth" strategy

MEASURES		IMPACTS								SUMMARY (measures)
		Economic capital		Human capital		Social capital		Natural capital		
		Criteria (representative indicators)								
		GDP growth	Investment intensity	Students per capita	Ageing	Unemployment	Migration	Abatement expenditure	Sewer connection	
Value-added growth	1st Development lag	+	+	+	0	+/-	-	+	+	+
	2nd Competitiveness	+	+	+	0	-	-	-	+	-/+
	3rd Investment promotion	+	+	0	0	+	+	+/-	+	+
	4th Endogenous advantages	+	+/-	+	+	+	+	+	+	+++
	5th Entrepreneurship	+	+	+	0	+/-	+	+/-	+/-	+
	Summary (capitals)	+++	++	++	0	+/-	+/-	+/-	++	+
		+++		+		+/-		+		

Source: Radej, 2006.

Ekins and Medhurst[7] were among researchers who first addressed four capitals using classical sustainability assessment frameworks. Later, a number of models using multiple capitals were developed by the World Bank, the Organisation for Economic Co-operation and Development and the UK Department of Environment, Food and Rural Affairs to recognize and distinguish the wider stocks and assets.

Organizations, such as the International Integrated Reporting Council, have incorporated the concepts of the multiple capital model into their work and developed discussion papers for consultation with their stakeholders on how the model can be applied to corporate reporting.[8] Countries, such as Norway, are now using a capital framework in their policy cycle.

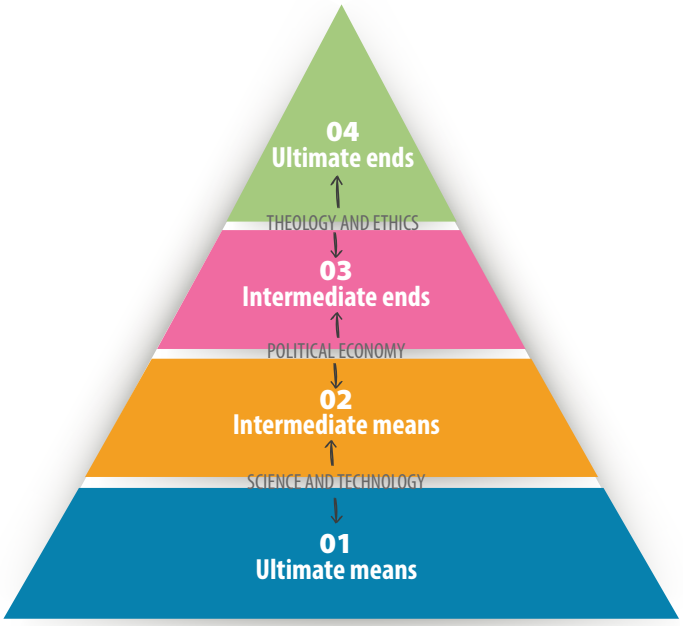
In what is known as the Daly Triangle (Figure 1), Daly[9] refers to the different forms of capital to describe various inputs that contribute to the ultimate objective of increasing human well-being. This recognizes that each form of capital contributes to human well-being in unique ways. In contrast, the understanding that all forms of capital are substitutable (the weak sustainability approach, explained further on) leads to the widespread acceptance that trade-offs are necessary and inevitable. For instance, if the services provided by the natural environment to the society and to the economy can be substituted by manufactured capital, then there is no need to conserve natural capital—it can be considered non-essential.

There is an assumption that the decline in other natural assets can be managed and that the needs of future generations will be met as long as there is no decline in economic output. Such an approach is referred to as **weak sustainability**, whereby natural and other assets are declining while that of manufactured capital grows. In such a perspective, natural capital and the services provided by nature can be substituted by manufactured capital and are valuable only as long as they contribute to economic growth and welfare.

It is increasingly evident, however, that below certain stock levels (**critical thresholds**), particular components of capital are non-substitutable. Neo-classical economic theory has traditionally held that as long as there is no decline in economic growth, substitutes for exhaustible resources can always be found. Thus, there are no resource constraints to economic growth. As human beings slowly but eventually discovered, even if resource limits are relative and can be overcome, the capacity of the planetary ecosystem to absorb the output of economic growth is limited.

There are absolute limits to the planet's carrying capacity, as evidenced through planetary changes in terms of global warming, climate change and biodiversity loss. It is in such a context, in which substitution between economic, manufactured or classic capital and natural resources or natural capital is recognized as unsustainable in the long term. This **strong sustainability approach** provides a more effective basis for policy formulation for integration that seeks synergies and integration of the three dimensions of sustainable development in policy outcomes.

The Daly Triangle



04
WELL-BEING:
Happiness, harmony, identity, fulfilment, self-respect, community, transcendence, enlightment

03
HUMAN CAPITAL & SOCIAL CAPITAL:
Health, wealth, leisure, mobility, knowledge, communication, consumer goods

02
BUILT CAPITAL & HUMAN CAPITAL:
Labour, tools, factories, processed raw materials

01
NATURAL CAPITAL:
Solar energy, the biosphere, earth materials, biogeochemical cycles

Source: Daly, 1973 in Meadows, 1998.

2.4 Understanding and dealing with trade-offs

Trade-offs are the unintended outcomes of policy that arise out of the failure to recognize various forms of capital (and their unique contributions) and the interrelationships between them. Trade-offs manifest in different ways, for example:

- between competitiveness and decent jobs;
- between capital-intensive investments and employment creation; and
- climate change caused transboundary externality and economic development.

Trade-offs can manifest differently at various levels, including:

- enterprises and households;
- locally and in cities;
- nationally; and
- regionally, subregionally and globally (in the context of regional integration).

There are four fundamental reasons for trade-offs:

- externalization of environmental and social values and the "tragedy of the commons";[10]
- the usually lengthy time between investments in socially and environmentally beneficial actions and returns on those investments;
- institutional capacity and governance shortcomings that foster policy conflicts instead of coherence;
- complexity, scientific uncertainty and stakeholder perspectives are not factored in time, or capacities do not exist to deal with the complexity and scientific uncertainty.

Externalization of environmental and social values occurs because of improper valuation in the market. Environmental values, such as the value of ecosystem services provided by nature, are not accounted for because they are excluded from markets, while social values, such as leisure time or time spent by women in the home, are not valued or are undervalued. Property rights with regard to common property resources, such as water resources or pastures, and public domain resources, such as knowledge resources, are also not well defined in markets. The answers may not always lie in market interventions and creation of property rights but instead may lie in policy and information-focused interventions.

The lengthy time between investments in socially and environmentally beneficial actions and the returns on those investments creates a mismatch between the short-term time horizon of markets and the long-term time horizon of sustainable development investments. Such a time gap between a socially or environmentally detrimental investment and action and the negative consequences normally occur in business-as-usual approaches. Action taken to lengthen stakeholder time horizons can include both policy and financing interventions; for example, preferential financing of solar power installations at the household level can make these investments with a longer-term time horizon feasible.

Governance gaps occur when institutional capacity and governance shortcomings foster policy conflicts instead of coherence (where there is undue influence of the private sector, for example); these shortcomings are a critical dimension of why trade-offs occur. Some examples include lack of attention to "constraining conditions", which support trade-off thinking; the promotion of private goods as opposed to the enhancement of public goods; and stakeholders insufficiently involved and/or empowered (or possessing too much influence). Weak or non-recognition of ecological or planetary limits; inattention to social justice and human rights; and weak economic governance (such as overfinancialization) are also important dimensions of governance shortcomings. To address governance gaps, it will be important to strengthen the institutional capacity for stakeholder engagement, set policy targets that acknowledge environmental limits and establish social protection floors, among other measures.

Lack of information means that policies are formulated and implemented without a full understanding of the impacts and opportunities for integrating the three dimensions of sustainable development. This requires strengthened stakeholder involvement, transdisciplinary approaches and a strengthened science-policy interface. Information can create synergies, for example, by changing market and social preferences or reducing perceptions of risk. Information reduces uncertainty and helps deal with complexity.

The critical question thus remains of how to address the trade-offs. The move towards synergy in the context of integrating the economy, society and the environment for sustainable development is about identifying the trade-offs and putting in place policies or other provisions to address the specific gaps and shortcomings that are at the root of those trade-offs.

Specific tools can be employed to address these gaps. The following section introduces two important tools: qualitative scenario building and quantitative input-output analysis.

3. Tools for integration

Integration of the three dimensions of sustainable development requires that policymakers have access to tools that help them better deal with complexity, that bring the perspectives of different stakeholders together and that provide better information on the impacts of different policy scenarios.

Although many tools exist, this section describes two complementing policy tools, qualitative scenario building and quantitative input-output analysis, which are relevant across most parts of the policy cycle, as indicated in Table 3.

Qualitative scenario building was chosen because of its timeliness and relevance to the 2030 Agenda and the SDGs adopted in September 2015. Agenda setting and policy formulation activities will now need to take place at various levels. Qualitative scenario building is useful for envisioning plausible futures. It provides narratives to describe what life in a particular region in the world might look like in 2030 if all or some of the SDGs were to be achieved. It is also a method and process that can support stakeholder learning, dialogue and social innovation, which are important means for and ends of sustainable development.

Many quantitative tools are available, such as modelling and sustainability indicators. This report features input-output analysis because of its usefulness for trade assessment and its relevance to the Asia-Pacific region, where trade has been an indispensable driving force of economic growth.[11] Input-output analysis can expose the carbon, biodiversity and material footprints of global and regional trade and assess the level of integration of a country, from the national context but also from the regional and global contexts.

TABLE 3. Stages of the policy cycle and applicability of tools

POLICY CYCLE STAGE	QUALITATIVE SCENARIO BUILDING	INPUT-OUTPUT ANALYSIS
Agenda setting	x	x
Policy formulation	x	x
Policy implementation		x
Policy monitoring and evaluation	x	x
Policy adjustment	x	x

3.1 A qualitative tool—Scenario building: In search of compelling narratives[12]

A key message of this section is that participatory qualitative scenario thinking could enhance the relevance and legitimacy of the SDGs.[13]

3.1.1 What is scenario thinking?

Certain aspects of the future are irreducibly ambiguous: Our language or knowledge cannot adequately describe them. Scenario thinking, however, allows many important aspects of the future to be anticipated and explored. Qualitative scenario thinking is a method and process that helps visualize uncertain but plausible futures. Defined as a "structured process of generating imagined future possibilities",[14] scenario thinking is:

- a method that enables non-specialists to influence and interact with technical discussions and specialists from different disciplines to understand each other; [15]
- flexible and applied in diverse applications, ranging from community visioning[16] to detailed narratives accompanying quantitative models;[17] and
- applicable at various scales of policy intervention. Scenario work can focus on alternative futures of an issue, region or organization[18] and is considered from multiple levels.[19]

Scenarios—the outputs of a scenario thinking process—are "plausible provocative and relevant stories about how the future might unfold".[20] Scenario work makes recurrent use of qualitative storylines, such as a description of how we might predominately use renewable energy in the future.[21] Qualitative storylines can appear in combination with quantitative models (for example, when the economic impact of various carbon tax levels is illustrated) but can also appear as stand-alone products, in the form of future visions.

Guided by facilitators, a gathering of people (in a participatory exercise) can select a set of driving forces, imagine plausible values or expressions those forces may take in the future and tell an unfolding story of a fictional group of actors (a family, community or entrepreneur) whose lives are shaped by and respond to those driving forces. The product of such a process is called a participatory scenario narrative.[22]

3.1.2 Why use qualitative scenarios for sustainable development policymaking?

Qualitative scenario thinking enables stakeholders to participate in agenda setting, in visioning (exploring alternative sets of futures that contain both desired and undesired events) and in policy development (to explore pathways of action towards desired future targets).[23] For sustainable development, qualitative scenario thinking is relevant for several reasons.

1. DEALING WITH COMPLEXITY AND UNCERTAINTY

The first reason that qualitative scenarios matter relates to the complexity of sustainable development, which is and will continue to be an inescapably contested discourse around what is to be developed,

what is to be sustained and how to do it.[24] The essential features of sustainable development might be summarized, for example, as the eradication of poverty by 2100, governance that is socially inclusive, demand on natural resources and sinks that does not exceed their regeneration capacity and sustainable patterns of consumption. [25]

That definitions will be contested also generates argument around facts as well as values. Despite the United Nations adoption of the SDGs, a lack of consensus prevails about the priority to be given to sustainable—as opposed to conventional—economic development. Can sustainable development be achieved by improvements in social equality and environmental management? This is the green economy model supported by many multilateral development organizations.

Alternatively, will sustainable development require a steady state economy in which human economy and society operate within finite ecological limits and, thus, a transition away from both the conventional and the green growth models?[26] Each of these alternatives to conventional development is imaginable, but which model an individual society might adopt, when and under what circumstances and with what degree of autonomy is uncertain. Qualitative scenario methods allow individuals to select important combinations of uncertain and difficult-to-autonomously-manage possibilities and explore their implications in more depth.[27]

2. ENGAGING THE PERSPECTIVES OF MULTIPLE STAKEHOLDERS AND SUPPORTING STAKEHOLDER LEARNING

Qualitative scenarios can support stakeholder learning and collaboration.[28] A qualitative scenario-building exercise involves multiple opportunities for individuals to exchange, debate and reach some level of agreement on what the future of a region or issue might look like and how to plan in support of the desired and potentially attainable aspects of that future.

Scenario storylines are well suited to exploring interactions between dimensions. Interactions and feedback described in an ordinary language narrative can be produced and absorbed by audiences more rapidly than quantitative storylines or qualitative academic discourse. Scenario storylines are thus a vehicle to explore integration between the dimensions of sustainable development.

3. STRENGTHENING QUANTITATIVE ANALYSIS

Model-based exploration of the economic, social and environmental dimensions of sustainable development dates back to the 1980s.[29] The results of such explorations, however, are limited by formal model structures and assumptions about systemic relations and may be opposed. Qualitative scenarios can provide essential input into quantitative models. Such inputs include descriptions of interactions between dimensions of sustainable development from the perspectives of different stakeholders, stakeholder-agreed development visions and specific goals and targets consistent with such visions. Thus, they provide a coherent context for quantitative modelling.[30]

Qualitative descriptions are also vital for interpreting and communicating the results of the quantitative scenarios.[31] Quantitative scenarios created to explore "sustainable worlds" typically contain large numbers of assumptions. For example, scenarios created to explore the future of food production and access to food may include technologically feasible assumptions about closing yield gaps and increased irrigation water use efficiency, assumptions about demographic transition, human capital development (increased access to education and rates of economic growth in developing countries, for example) and assumptions about particular levels of global warming.[32]

Under particular assumptions, simulation models demonstrate that the SDGs can be met; for example, increased food production is possible without depleting land and water resources. Such descriptions, however, are typically not communicated in a multidimensional storyline that allows an audience to visualize future societies in detail (whether as detailed "snapshots" or through unfolding narratives). Additional work is required to link the modelled results of a sustainable world scenario to coherent descriptions of (i) rural social change, (ii) broader societal changes in terms of prosperity, well-being, sufficiency and equity and (iii) changes in institutions and everyday life consistent with the modelling assumptions.[33]

4. AGENDA SETTING — DEVELOPING A COMPELLING NARRATIVE FOR A SHARED FUTURE

Commenting on the SDGs, a 2015 report by the International Council for Science and the International Social Science Council states that:

> "The 'ultimate end' of the SDGs—in effect an overarching goal—and how the 17 goals and targets would contribute to achieving this end, needs to be more compelling. . . . To be effective in communicating the SDGs it is necessary to have a compelling narrative to describe how the world could look when the SDGs are fully achieved. . . . Articulating this narrative would enhance the capacity to deal with trade-offs and synergies among the 17 goals since it must describe a world where the trade-offs and synergies have been resolved. It can also enhance public discussion of the type of future we actually want." [34]

This call for a compelling narrative is echoed in the United Nations *Global Sustainable Development Report*.[35] Qualitative scenario thinking can supply more than one compelling narrative. Considering that development is typically uneven and fragmented, more than one narrative is necessary.

Qualitative scenario work can generate plural descriptions of dynamic pathways of societal change, not just a static future vision. Storylines could vary, based on different theoretical accounts of how societies can or cannot be steered to make major changes (reformist, revolutionary or reconfiguration pathways).[36]

In addition, scenarios can be used as an input to planning discussions on what change needs to occur, how and by whom.[37]

3.1.3 Limitations

Scenario approaches have a number of characteristic limitations. First, they can be time and resource intensive. Second, for policy actors focused on the near term or on forecasting, their properties may be regarded as speculative, irrelevant or fanciful. These properties include a non-predictive, multiple decadal-scale orientation; a willingness to challenge the status quo; an interest in multiple futures; and an interest in holistic depictions of change and transformation.[38] Third, the potential of scenario methods to support deep and imaginative exploration of futures relies on an ability to detect and transcend conventional worldviews or beliefs. Fourth, the link between scenario activities and development outcomes can be tenuous.[39] These sorts of limitations can apply to quantitative as well as qualitative scenario approaches.

Resource requirements can be reduced by designing the scenario activity to fit its purpose, noting that requirements increase when the purpose shifts from exploratory dialogue to more formal and detailed decision support. The second limitation (low relevance to decision makers) could be reduced by emphasizing the unique properties of qualitative scenario thinking, including its ability to explore beyond the mandate of a particular actor, and its ability to support reasoned exploration of contested issues.

The limitations of conventional thinking can be met through iterative processes that combine qualitative scenarios with other knowledge-generating processes or products to refine the conventional or simplistic thinking. Examples of such processes include systems diagrams,[40] participatory modelling,[41] relevant qualitative scenarios generated in other exercises[42] and discussions of scientific evidence.[43]

The gap between scenario thinking and development outcomes could be addressed at two levels. First, scenario outputs could include no-regrets or low-regrets recommendations—that is, actions that are desirable because they are likely to provide benefits across a range of alternative futures.[44] Second, organizers of such a participatory exercise could explicitly map out their "theory of change"—how scenario thinking activities and outputs will change what other actors know, say or do about a sustainable development issue.[45] This requires organizers to have some understanding of what actors in a particular policy domain currently know and believe and how actors interact (or not) with each other.[46]

3.1.4 Knowledge and information requirements

A qualitative scenario process can and should make use of diverse types and sources of knowledge, including the knowledge of participants and studies on sector-based issues and trends. The extent to which published scientific knowledge is required will depend on the specific purpose of the exercise. For example, if the purpose is to raise awareness of development practitioners about emerging, long-term challenges in a participatory exercise, organizers could elicit participants' knowledge of the issue, along with their values and vision for the future (including both desired and undesired elements). In this case, the essential knowledge inputs would consist of (i) a minimum amount of information related to the state and trends of the focal issues as well as relevant drivers, pressures and governance responses along with (ii) a review of relevant literature.

The review should focus on the uncertainties identified in scenarios as well as descriptions in studies of historical or emerging institutions, actors, ideas and policy strategies. Based on the minimum information and a review of literature, organizers would then offer a scenario framework[47] as the foundation to support the elaboration of two or more qualitative storylines.

A formal scenario planning exercise could also begin in this manner, drawing more extensively on status and trend data for technological, environmental, social and political factors. Additional knowledge elements include descriptions of significant change events (crises, political accords, environmental tipping points) as well as detailed descriptions of the dynamics of adoption or resistance to various social, ecological and technological driving forces.

3.1.5 In search of compelling narratives

Qualitative scenarios have a role in catalysing action towards sustainable development. For this role to be performed effectively, organizers need to understand the existing actors and dynamics of development policymaking. Assuming there is an interested actor with legitimacy to convene scenario work, the potential exists to create compelling, pragmatic and holistic accounts of what sustainable societies, at subnational, national or international levels, could look like and how they would relate to each other.[48] Useful narratives would explore what and how change occurs and by whom, supporting explicit discussion of tensions and synergies between dimensions of sustainable development and between classes of actors in global society.

Literature is easily available on scenarios as a social process, including their design and related technical issues.[49] In particular, Roehrl as well as Ozkaynak and others review quantitative sustainable development scenarios.[50] However, most of the detailed qualitative sustainable development storylines originate from the global North;[51] although, as Table 4 presents, notable examples from developing regions are available.[52]

TABLE 4. Examples of qualitative scenario thinking

Exploring Mekong region futures ***Dynamic character-driven narratives produced by non-specialists***	More than 200 people participated in a series of 11 scenario-building workshops organized in six settings in the Mekong region (North-East Thailand; Tonle Sap, Cambodia; Mekong Delta, Viet Nam; Xishuangbanna, China; Nam Ngum Basin, Lao People's Democratic Republic; and a regional gathering). A total of 21 final narratives were produced. Analysis of the storylines created by participants revealed that the story protagonists, 50 per cent of whom were women, changed locality and livelihood, frequently taking risks voluntarily as well as experiencing it involuntarily. A common theme was that well-being will improve if people can stay in rural areas and avoid the instability of work, especially low-skilled wage labour in cities. Several expressed a vision in which people do well working in family or community enterprises involved in organic farming, aquaculture, carbon forestry and ecotourism. Some stories imagined that if environmental governance improves, such enterprises could coexist near heavier industry, providing rural non-farm employment for farmers displaced because of inability to compete. Many narratives used the story as a vehicle to show how uncertain drivers manifested themselves over time and to what effect on the lives of the focal characters and their families.

	Stories included multiple setbacks and reversals. For example, in a Xishuangbanna story, the protagonist is a rubber farmer who expands his holdings, then after experiencing natural disasters and expropriation, diversifies profitably into ornamental flowers and restoration of his rubber plantations. Storytellers imagined future worlds in which individuals and their families followed opportunities created through higher-level policies, such as payments for environmental services and carbon forestry. Stories featured protagonists who pursued such "opportunities" early in their careers as well as those that did so only much later, after other livelihood setbacks in the conventional economy. *Source*: Foran, and others, 2013.
Goa, India, 2100 ***A future snapshot describing urban and regional sustainability***	The qualitative scenario thinking described how the city of Panjim (capital of Goa State in India) and its wider region could meet multiple goals of sustainable development: combining high-quality living conditions, a successful economy and sustainable levels of resource use and waste generation. Scenario narratives included social, economic, environmental and technological changes that were expected to take place over the next century. The business-as-usual scenario would maintain the current trajectory of reactive development and would lead to rapid economic, population and urban growth, driven largely by in-migration; this would devastate the environment and, by 2050, would leave Panjim looking like the corridor towns that circle Mumbai. By contrast, the sustainability transition scenario, led by intense community consensus building, would rejuvenate local government. This would lead to urban consolidation to reduce ecological footprints, to integrated agroforestry and ecosystem regeneration throughout the region and to the transformation of the energy and water systems and transport and communications networks. This would build a high-technology but green economy and transform the city's identity. By 2030, Panjim could become one of the top-five cities in the Indian Ocean region in terms of quality of life. . . . Goa's high levels of per capita income and human development provide an important springboard in developing a range of livelihoods linked to critical new-economy areas. Biotechnology, ICT, advanced materials, human and financial services and ecotourism were projected to be important livelihood opportunities of the future. However, a strong emphasis on community-based activity in the areas of sustainable agriculture, forestry and aquaculture, renewable energy and health and education will be necessary to maintain a sustainable metabolism for the city. An important challenge will be coping with the migration from other parts of India to Panjim in an inclusive manner, without challenging the local social and cultural fabric. *Source*: Revi, and others. 2006.

The literature on qualitative scenarios and sustainable development appears to be growing.[53] To parse the voluminous scenarios literature, an ability to classify scenarios is helpful.[54] From the perspective of creating more compelling qualitative narratives of development, Box 3 provides examples of issues that the reader may want to consider. The issues are classified under three interacting dimensions: development content, qualitative content and scenario process.

BOX 3. Issues to consider in assessing qualitative scenarios for sustainable development

Development content

- How are relations between the economy, society and environment conceptualized?
- Does the application focus on a specific dimension or attempt to provide multidimensional coverage of sustainable development?
- How is change conceptualized?
- Does an overarching development narrative influence the content?
- What weight is given to incremental versus transformative change?
- How is capitalist economic development conceptualized?
- How is agrarian change conceptualized?
- Does an overarching development narrative influence the content?
- How are synergies and trade-offs between dimensions represented?
- What assumptions are made about biophysical or social limits or thresholds?

Qualitative scenario content

- Storyline dynamics: What processes of change are described? What levels of temporal, social and geographic resolution are featured?
- What classes of actors are featured? Which actors mobilize for change and which resist change?
- How evocative are descriptions and visualizations?
- What are the most and least persuasive elements of the scenario?

Scenario process

- What were the objectives of the application (dialogue, exploration, normative visioning, formal planning, dissemination)?
- What types and numbers of participants were involved?
- What outputs and outcomes ensued?

3.2 A quantitative tool—Input-output analysis

Globalization has given rise to a need for global analytical capacity to facilitate sustainability research.[55] Input-output analysis is one useful way to satisfy this capacity need. It provides a framework and comprehensive, easy-to-use, versatile and widely accepted tools for enumerating economic, environmental and social interactions at organizational, national and global scales. Consequently, it has received significant attention in the past few decades for facilitating the formulation of policy responses to economic, social and environmental problems.

Underpinning these policies are reliable and academically rigorous research capabilities provided by input-output and multiregional input-output analysis. The outcome of environmental and social multiregional input-output analysis is a set of multipliers that show the full global upstream environmental and socioeconomic impacts of production to satisfy one unit of final demand (such as final indicator values of CO_2 emissions, water use, employment generation or wages earned by workers associated with a dollar of consumption in a particular country). Total impacts, flowing through the complex supply chains and embodied in a particular country's consumption (consumption-based footprint) or in activities of specific sectors in a particular economy can then be estimated. These results can be used for informing policy not only globally or regionally but also at a national level.

3.2.1 What is input-output analysis?

Input-output analysis is a quantitative analytical framework that can be used for studying any relevant variable or variables of interest as they relate to the interindustry production and consumption structure of an economy.[56] It is a well-established framework suitable for linking together the economic, environmental and more recently, social dimensions of trade in interdisciplinary studies. Developed by Nobel Prize-winning economist Wassily Leontief,[57] this model has become a workhorse in sustainability analysis. It is

able to establish links between resources and impacts associated with the use of resources, from particular sectors or location of production throughout the supply chain to the consumer of the final goods.

Some notable work has applied this method to evaluate environmental impacts as a consequence of global trade, such as carbon,[58] biodiversity[59] and material footprints.[60] More recently, social impacts, such as labour and inequality,[61] were added. The input-output analysis method is a useful tool for performing quantitative integrated assessments in support of sustainable development by exposing areas of concern, sometimes known as "hotspots" that require attention and policy responses.

BOX 4. The arithmetic of input-output analysis

The input-output model captures transactions between different sectors and actors—households, firms, government and the rest of the world—in the economy, regions or countries, depending on the chosen scope of study. Its basic structure is best depicted in a tabular form (such as Table 5). Here, the unit of interest is a single economy. The column labels refer to the consumption of intermediate and final output while the row labels refer to the supply of intermediate and primary input, or value-added. The entries inside the table represent financial flows or monetary payments from the columns to the rows for the physical flow of products or services from the rows to the columns. In Table 5, the intersection of the Agriculture row and the Manufacturing column represents the amount of the agriculture sector's output needed as input for the manufacturing sector. All the shaded cells can be interpreted similarly, thus the shaded area encapsulates the intermediate demand of the different industrial sectors for output of the other sectors, including their own; for example, it comprises the interindustry transactions. The inclusion of final demand and value-added in the table ensures that the system is balanced and is in general equilibrium.

TABLE 5. Input-output transactions table

		PRODUCERS AS CONSUMERS								FINAL DEMAND			
		Agriculture	Mining	Construction	Manufacturing	Trade	Transp.	Services	Other	Personal Consumption Expenditure	Gross Private Domestic Investment	Govt. Purchase of Goods & Services	Net Exports of Goods & Services
PRODUCERS	Agri.												
	Mining												
	Const.												
	Manuf.												
	Trade												
	Transp.												
	Services												
	Other Industry												
VALUE ADDED	Employees	Employee compensation								GROSS DOMESTIC PRODUCT			
	Business Owners and Capital	Profit-type income and capital consumption allowances											
	Government	Indirect business taxes											

Source: Miller and Blair, 2009.

Input-output analysis is conveniently handled with the use of matrices. Generalizing the model and assuming there are n number of sectors, r final demand categories and k value-added categories, the shaded part in Table 5 can be alternatively referred to as the interindustry transactions matrix **T** with $n \times n$

dimension (*n* rows and *n* columns), the bottom part as the $k \times n$ value-added matrix **V** and the right side as the $n \times r$ final demand matrix **Y**. By definition, total output, henceforth denoted as **X**, is the total production in the economy of both intermediate input (**T**) and goods destined for final demand (**Y**). The interindustry links are expressed in terms of per dollar output of each sector by dividing elements of matrix **T** by **X**, thus yielding the direct requirements, or input coefficients matrix **A**. The input coefficients matrix holds the so-called production recipes of industries, describing the direct links between industries. The input-output identity $\mathbf{X = T + Y}$ can then be rewritten as $\mathbf{X = AX + Y}$, where its solution $\mathbf{X = (I-A)^{-1} Y}$ relates consumption of final demand (**Y**) to production of output (**X**) via the well-known Leontief inverse $\mathbf{L = (I-A)^{-1}}$. In the foregoing, **I** is an $n \times n$ identity matrix. The derived input-output relationship is alternatively expressed as $\mathbf{X = LY}$. Whereas the input coefficients matrix **A** only describes the direct links between industries, the Leontief inverse **L** captures both the direct and indirect input requirements for meeting a dollar of final demand.

Any statistic that is related to the production structure of the economy can be introduced as a satellite account. Each of the satellite accounts must be converted from its level value, say **Q**, to its corresponding intensity **q** by dividing it by the output per sector so that the indicator is expressed in units per dollar of output. For example, the mining sector employs 1,000 full-time equivalent (FTE) workers (**Q**) to produce $2,000 worth of production (**X**). This means half FTE employment (**q**) is generated per dollar of mining output.

The last step in the input-output arithmetic involves combining the indicator with the previously derived input-output relationship as $\mathbf{q\ X = q\ L\ Y = m\ Y}$ to generate the final indicator values in the form of **m**, containing the so-called multipliers. The multiplier represents all direct and indirect effects (direct and embodied employment generated to meet a dollar's worth of consumption) throughout the interindustry link of the entire economy and allocated by the Leontief inverse **L**. These final indicator values account for both the direct and embodied values of the indicator or satellite account referenced against a dollar of final demand or per dollar spent on everyday consumption.

The basic model described in Box 4 can flexibly accommodate extensions to incorporate economic, social and environmental indicators or satellite accounts of any unit, physical or monetary, as long as they can be attributed to the sectors or industries in the model. For example the University of Sydney's Triple Bottom Line report of the Australian economy[62] uses various environmental, social and financial indicators, such as greenhouse gas emissions, primary energy use, managed water and land disturbance, employment generation, income and government revenue, profits, export propensity and import penetration.

3.2.2 Why use input-output analysis?

CAPTURING INDIRECT ECONOMIC, SOCIAL AND ENVIRONMENTAL IMPACTS

One of the most important advantages of input-output analysis lies in its ability to capture indirect impacts embodied in the vast interconnected supply chain networks. These interconnected supply chains can be examined to assess the economic, social and environmental impacts of doing business using a single comprehensive framework. Policymakers can use this framework for assessing the impacts of international trade on all three spheres of sustainability, which in turn uncovers the trade-offs between the indicators of sustainability. For example, an industry might be generating employment for the regional economy at the cost of polluting the environment. Quantifying such impacts enables policymakers to avoid second-best solutions and seek win-win outcomes by understanding the overall effects and trade-offs of doing business.

ACCOUNTING FOR BOTH PRODUCTION AND CONSUMPTION-RELATED PHENOMENA

The power of input-output analysis becomes even more eminent in the present globalized world, where there is noticeable decoupling of the location of production from that of consumption (by countries). This decoupling can be mathematically studied using a multiregional input-output table. Such a table, when extended with data on environmental indicators (for example, greenhouse gas emissions) and social indicators (for example, inequality) harbours all necessary information for quantifying the emissions and inequality embodied in the final consumption of goods and services by a specific country. Such an analysis is often termed as consumption-based accounting.[63]

This is different from production-based accounting, which only considers territorial emissions (emissions from the country) and does not take into account emissions embodied in the goods produced elsewhere but consumed in the country. Choice of the accounting procedure—production based or consumption based—greatly affects the amount of greenhouse gas emissions or inequality that is attributed to a nation. This in turn has consequences, for example, for climate policy measures that impose emission reduction targets for a nation or for reducing inequality that is prevalent in developing countries and in some industrialized countries, such as the United States and the United Kingdom.[64]

Production-based accounting employed under the Kyoto Protocol to the United Nations Framework Convention on Climate Change does not take into consideration the phenomenon of carbon leakage. In essence, carbon leakage refers to the outsourcing of carbon-intensive production to pollution-haven countries.[65] Studies have shown that territorial emissions in industrialized countries, such as Germany and the United Kingdom, have reduced considerably at the expense of an increase in territorial emissions in developing countries, such as China.[66]

Undoubtedly, if a production-based accounting measure is employed to inform policymaking, Germany and the United Kingdom would register a decrease in emissions while China recorded an increase. More recently, there has been a shift from production-based to consumption-based accounting, in which consumers are deemed responsible for the emissions and inequality that results from their acquisition of goods and services.[67] New, improved theoretical frameworks for input-output-dependent consumption-based greenhouse gas accounting have been proposed.[68] These frameworks are expected to offer improved mechanisms for effective climate policy design and implementation.

EXPLORING OTHER SECTORS

In addition to climate policy, the role of input-output analysis in infrastructure planning[69] is also gaining traction.

As powerful as input-output analysis may be as a quantitative tool, the assumptions of the model present some limitations. The model assumes linearity, fixed proportions and non-substitutability between resources so that the production recipe is assumed to be true regardless of the amount of demand or availability of resources. It also does not reflect the reallocation of resources that may happen from price changes arising possibly from changes in relative supply and demand. These considerations should then serve as caveats in interpreting results from input-output analysis.

3.2.3 Knowledge and information requirements

For single country analysis in which the focus is not on links with the rest of the world, national input-output tables are the ideal data to use. National input-output tables consisting of supply tables, use tables and symmetric input-output tables are typically compiled by individual countries, based on the guidelines provided by the United Nations System of National Accounts (SNA).

The SNA also provides guidelines on the elaboration of satellite accounts, such as employment, capital, energy, environmental accounts and other impact tables. Compilation of input-output tables and their extensions, however, may be challenging for some countries with less developed statistical systems.

Environmentally extended and socially extended multiple region input-output analyses have become possible with the development of a handful of global input-output datasets, such as the Asian International Input-Output Table by the Institute of Developing Economies, Japan External Trade Organization (www.ide.go.jp), the Eora MRIO database by the University of Sydney (www.worldmrio.com), the EXIOBASE funded by the European Union (www.exiobase.eu), the GTAP 9 Data Base of the Global Trade Analysis Project (www.gtap.agecon.purdue.edu) and the World Input-Output Database of the University of Groningen (www.wiod.org/).[70] Each database has its unique features, and all were built to perform specific tasks. But all of them, in some way, map the movement of goods and services around the world and can be applied at a national as well as global level.[71]

Other extensions and applications of the input-output framework include a social accounting matrix, structural decomposition analysis, multiplier decompositions, structural path analysis and life cycle assessments. Input-output analysis also complements computable general equilibrium modelling and analysis because it serves as an important input to the model. Given its simplicity and tractability, the

input-output framework offers a good foundation for undertaking more complex integrated sustainability analyses (Table 6).

TABLE 6. Extensions and applications of the input-output analysis framework

INPUT-OUTPUT ANALYSIS-RELATED ANALYTICAL TOOLS	WHAT THEY ARE AND HOW THEY USE INPUT-OUTPUT ANALYSIS
Social accounting matrix (SAM)	An input-output table in supply and use format with details on transactions involving household groups. • Useful for distributional analysis. • Uses the same input-output analytical framework.
Structural decomposition analysis (SDA)	Compares states at different points in time by comparing input-output tables from different periods. • Measures relative contribution of factors that cause the structural change.
Structural path analysis (SPA)	Identifies important paths of transmission in the economy using input-output tables. • Shows how an injection of spending in the economy gets transmitted in the economic structure in terms of increase in production or income.
Multiplier decomposition analysis	Related to SPA, it breaks down the contribution of each portion of the path on how spending gets transmitted in the economy.
Life cycle assessment (LCA)	A cradle-to-grave analysis that is built around an input-output table.
Computable general equilibrium (CGE)	An expanded input-output or general equilibrium analysis that considers the full workings of the economy, including price adjustments. • Uses input-output database together with other behavioural and non-behavioural economic equations for policy simulations.

4. Conclusions

Integration of the three dimensions of sustainable development is not merely an aspiration, it is vital for the survival of societies, ecosystems and economies. In addition to the tools and concepts discussed in this publication, there will need to be shifts in attitudes, behaviours and knowledge competencies.

Attitudinal shifts are a result of profound alterations in thinking and perspectives. The first attitudinal shift necessary to achieve sustainable development is recognition of the need to move from a short-term view to a long-term view of the economy, society and environment.

Next, there must be a move from a narrow sectoral approach to a more holistic approach, with sustainable development as an overarching framework. Sectoral approaches tend to see trade-offs as a given, whereby sacrifices in social or environmental conditions are seen as necessary for the achievement of the short-term economic gains. Trade-offs are not a given, however. Public policy often tends to be made on the basis of trade-offs and uses trade-offs in the formulation of critical decisions. It is necessary to change the focus of policymaking from negotiating trade-offs to developing and achieving synergies and new sustainable outcomes.

Shifts in attitudes take place at two levels—the cognitive and affective levels. Both of these are explained in systems thinking as at the core of many problems. They are often not obvious and are difficult to change. The shifts in these domains need to work in tandem.

As we begin to understand that we are working within contexts of complexity and uncertainty, we may cognitively begin by applying the precautionary principle. The precautionary principle in policy also ensures that inclusive multistakeholder engagement and the participation principle are built into policy formulation. At the cognitive level, another shift needed is to treat ethics as intrinsic to development issues. Recognition of ethical dimensions (rights-based approaches) is central to poverty alleviation and

the creation of environments conducive to universal human rights, which allows people to live in dignity, as declared in the 2030 Agenda for Sustainable Development.

Next, attitudinal change at the affective level needs to take place through the recognition that an extended scope of knowledge is required for sustainable development. With an extended scope of knowledge, the skills and competencies necessary for the integration of the three dimensions of sustainable development can be achieved. Skills are a learned ability to bring about a desired result. Competencies are what we develop through the concrete practice of applying the knowledge in terms of concepts and tools and the skills that we develop as we go through the "how" of achieving a task.

The challenges of a new policy environment emphasize the need for increased support to policymakers in taking steps to address the challenges of integration. This publication attempts to fill the need for strengthened public policy choices.

Endnotes

1. Steffen and others, 2015.
2. ESCAP, 2015.
3. Systems dynamics apply computer modelling to create simulation models of different systems to see how different variables would behave and what feedback loops are generated within a system.
4. Ekins, 1992.
5. See http://integratedreporting.org/wp-content/uploads/2013/03/IR-Background-Paper-Capitals.pdf.
6. Radej, 2006.
7. Ekins and Medhurst, 2003. See also Ekins, 1992 and Ekins, 2000.
8. See http://integratedreporting.org. See also http://drcaroladams.net/exploring-metaphors-of-capitals-and-the-framing-of-multiple-capitals-challenges-and-opportunities/.
9. Daly, 1973 in Meadows, 1998.
10. a term which describes the degradation of resources which often occurs when there is no clear ownership (for example overexploitation of fisheries)
11. ESCAP, 2014.
12. This section on qualitative scenario building is an output of the ICP Scenarios Project, funded by the CSIRO Climate Adaptation Flagship. The author thanks Erin Bohensky for insightful comments that improved the manuscript.
13. ICSU and ISSC, 2015.
14. Bohensky and others, 2011.
15. Garb and others, 2008b.
16. Evans and others, 2006.
17. Rothman and others, 2007; Tonn and others, 2010; Ozkaynak and others, 2012; Roehrl, 2012.
18. van Notten and others, 2003.
19. Foran and Lebel, 2007; Kok and others, 2007.
20. Bennett and others, 2005; Carpenter and others (2005, p. 547) define a scenario as "a plausible and often simplified description of how the future may develop, based on a coherent and internally consistent set of assumptions about key driving forces (rate of technology change, prices) and relationships. Scenarios are neither predictions nor projections and sometimes may be based on a 'narrative storyline.' Scenarios may include projections but are often based on additional information from other sources." Other, comparable definitions of scenario appear in March, and others, 2012.
21. See, for example, Tonn and others, 2010.
22. A narrative can be defined as "the representation of events and characters in some causal or at least non-coincidental sequence", as told by a narrator (Safire, 2004).
23. Wangel, 2011.
24. Redclift and Springett, 2015.
25. Roehrl, 2012, p. 94.
26. See, for example, (e.g. Schor, 2010; Costanza and others, 2015; Geels and others, 2015.
27. Peterson and others, 2003; Bohensky and others, 2006.
28. Johnson and others, 2012.
29. Roehrl, 2012, p. 12.
30. Garb and others, 2008a; Foran and Lebel, 2012; Fortes and others, 2015.
31. Alcamo, 2008; Ozkaynak and others, 2012.
32. Ozkaynak and others, 2012, p. 456.
33. Ozkaynak and others, 2012.
34. ICSU and ISSC, 2015, pp. 9–10. Emphasis added.
35. UNDESA, 2015, p. 43.
36. Geels and others, 2015.
37. Wangel, 2011; Nieto-Romero and others, 2016.
38. Mulvihill and Kramkowski, 2010.

39. Oteros-Rozas and others, 2015; Nieto-Romero and others, 2016.

40. Mitchell and others, 2015.

41. Schmitt Olabisi and others, 2010.

42. Foran and others, 2013.

43. Smajgl and others, 2015.

44. Enfors and others, 2008.

45. Garb and others, 2008b, Oteros-Rozas and others, 2015.

46. Weible and others, 2012.

47. Refers to a structure designed to allow exploration of outcomes that a number of critical driving forces could take, along with unfolding governance interventions in response to those forces. Driving forces are issues or factors that have an influence on the system and that are usually out of the short term control of policy makers. Driving forces can be classified according to whether they are essentially social, technical, economic, environmental, or political.

48. Ozkaynak and others, 2012, p. 467.

49. Evans and others, 2006; Jäger and others, 2007; Henrichs and others, 2010; Foran and others, 2013; Butler and others, 2015.

50. Roehrl, 2012; Ozkaynak and others, 2012.

51. See, for example, Rothman and others, 2007; Wangel, 2011; Randers, 2012; Carpenter and others, 2015.

52. Carpenter and others, 2005; Revi and others, 2006; Enfors and others, 2008; Foran and others, 2013.

53. For example, a November 2015 search conducted in Google Scholar using search terms "qualitative scenario" and "sustainable development" yielded approximately 316 results, 100 of which were published between 2013 and 2016.

54. See, for example, van Notten and others, 2003; March and others, 2012.

55. Wiedmann and others, 2011.

56. See Murray and Wood, 2010.

57. Wassily Leontief was awarded the Nobel Prize for economics for his work on input-output tables.

58. Hertwich and Peters, 2009.

59. Lenzen and others, 2012.

60. Wiedmann and others, 2013.

61. Alsamawi and others, 2014a; Alsamawi and others, 2014b; Simas and others, 2014; Murray and others, 2015.

62. See www.isa.org.usyd.edu.au/publications/balance.shtml.

63. Davis and Caldeira, 2010.

64. See Alsamawi and others, 2014b.

65. Peters and others, 2011.

66. Barrett and others, 2013; Baiocchi and Minx, 2010.

67. See Alsamawi and others, 2014b, who quantify the inequality footprint of international trade for more than 180 countries.

68. Bastianoni and others, 2014; Kander and others, 2015.

69. Daniels and others, 2011.

70. See Murray and Lenzen, 2013.

71. See Tukker and Dietzenbacher, 2013 for details.

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Useful web resources

Sustainable development and planetary boundaries

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Coulson, A, and others (2015). Exploring metaphors of capitals and the framing of multiple capitals: Challenges and opportunities for <IR>. Sustainability Accounting, Management and Policy Journal, vol. 6, No. 3, pp. 290–314. Available from http://drcaroladams.net/exploring-metaphors-of-capitals-and-the-framing-of-multiple-capitals-challenges-and-opportunities/.

Systems thinking and dynamics

Center for Sustainability Transformation. See http://sustainabilitytransformation.com/.

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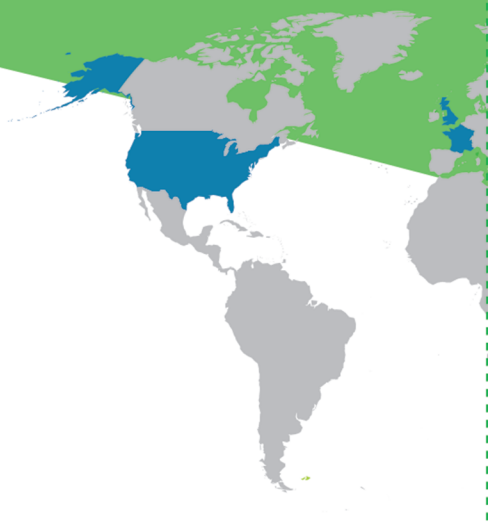

The blue areas of the map represent the members and associate members of ESCAP

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