Integrated Sustainability Assessment: toward a new paradigm

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Abstract

There is an urgent need to improve our capacity to assess the sustainability of systems relevant to development processes and the sustainability impact of policies and other drivers of change on these. Crucially, there is a clear demand from policy makers for improved sustainability assessments of policies in order to assure good governance. Although sustainability assessment of policies is practised already through a regime of integrated assessment that incorporates some sustainability impacts, assessment today is partial. The scope of today's assessment tools is too limited to capture all relevant impacts and the quality of assessments is limited by gaps and weaknesses in available tools and methods. Assessment is not practised comprehensively across all relevant levels and domains of policy making and is mostly restricted to sectoral level (rather than more strategic, cross-sectoral) policy assessments. Even in this limited implementation sphere, assessment is methodologically inconsistent across applications. This paper reflects on the challenges of improving the processes and tools of sustainability assessment and on how these challenges might be met through a new assessment paradigm of Integrated Sustainability Assessment.

(Key words: Integrated Sustainability Assessment, multi-level governance, policy assessment, sustainability impact assessment, quality assurance of governance)

1. Introduction

This paper reviews the potential contribution that enhanced sustainability assessment processes and improved assessment tools could make to sustainable development and governance quality. The paper identifies and prioritises the key scientific and institutional challenges of improving sustainability assessment tools, methods and processes. It suggests that a new assessment paradigm of integrated sustainability assessment is needed and puts forward a two-track strategy for developing such a paradigm based on improving and inter-linking existing tools and methods for sustainability assessment while simultaneously working to develop a next-generation assessment toolkit. Crucially, development work on both tracks should be based on a co-production model, which envisages policy makers, tool developers, tool users and stakeholders in policy assessment processes working together at the science-policy interface to identify relevant questions and information needs and to generate the necessary tools, capacities and capabilities to address these. The two-track approach described in the paper forms the basis of a Framework 6 project of the European Commission, Methods and Tools for Integrated Sustainability Assessment (MATISSE).

2. Sustainable development and policy processes

Although sustainable development is a contested notion - on account of its essentially normative and subjective character, its complexity and the ambiguities this implies - it has features that are common even across divergent interpretations. It is an intergenerational phenomena. It concerns equity. It operates at multiple scale levels. And, it covers social, economic, and ecological dimensions. Sustainable development is an overarching policy objective that has been adopted by the European Union (EU) and by constituent institutions of governance at all levels (national, regional and local). Policy-making processes, however, remain largely sectoral in scope and orientation. A further complication is that policy making in the context of the EU involves multi-level governance processes, with powers and responsibilities for policy making, strategy determination and implementation at different levels split across the governance hierarchy.

Thus, sustainability assessment of policies is an intrinsically complicated task. Capacity is needed to assess policies in many, very different, mostly sectoral, policy making domains. Assessment must embrace a wide range of potential impacts, which involve causal chains, interactions and impacts that cut across domains, systems, scales, space and time. Since equity between and among generations is intrinsic to the notion of sustainable development, the distribution of impacts is as much of a concern as

is the type and size of impacts, which puts premium on the capacity for disaggregated analyses. Equally, policies and strategies may need to be assessed several times and from different perspectives in order to address information needs that arise at different levels in the governance hierarchy.

Concerns in respect to the prospective sustainability impacts of existing sectoral policies and policy alternatives include avoidance of conflicts between policies that have been independently-developed in different domains (e.g., trade-offs between policy objectives pursued in different policy domains, transgression of sustainability thresholds owing to aggregation of impacts from different policies, incompatibilities between policies, etc.), avoidance of spill-over impacts (i.e., unintended, undesirable and unsustainable impacts or externalities), avoidance of problem-shifting (e.g., when a problem is not actually solved but is simply moved to another domain, shifted into the future or exported), and avoidance of perverse policy responses (e.g., where policy outcomes respect the letter but not the spirit of the law or where short-term policy responses have the effect of locking out better longer-term solutions). There is concern, also, over whether sectoral-policies, individually and in combination, will contribute fully enough to achieving the overarching policy goal of sustainable development.

In respect to the last of these, it is important to clarify that there are likely to be limits to the contribution to sustainable development that can be achieved through purely sectoral policies. Given the systems-nature of the persistent, structural problems of unsustainable development, their resolution is likely to require broad structural changes (transitions), which depend on revision both of development processes and the institutions in which they take place. It is one thing to assure that policies designed primarily to achieve sectoral objectives are not inconsistent with one another or with sustainable development, but something else entirely for policies actively to support transition toward sustainable development. In order to achieve the latter, future policies may need to be designed with sustainability as a specific objective. These would need to be cross-sectoral. There is therefore a potential longer term role for sustainability assessment in supporting the design of integrated sustainability policies and in their integrated and systemic analysis.

Thus, assessment is a multi-functional and multi-faceted process with the potential to play different roles along a spectrum stretching from meeting immediate and pragmatic information needs in sectoral policy making domains to addressing longer term and more strategic questions concerned with the development and design of integrated cross-sectoral, sustainability policies and strategies. In principle, sustainability assessment could involve a wide range of related tasks along this spectrum, such as sustainability progress monitoring, sustainability impact assessment and evaluation, integrated policy assessment and development, backcasting and forecasting of sustainable development, and managing the transition towards sustainable development. Importantly in the context of such a wide range of possible applications, would be to develop multi-purpose tools and methods with the capacity to be used to perform all of these tasks. This is possible, in principle, if this is made an explicit design criterion.

3. The demand for sustainability assessment

The need for sustainability assessment of policies is already recognised by policy makers. The Gothenburg decision, which established the EU Strategy on Sustainable Development, identified sustainability assessment as one of the main "grips" by which the Strategy can be implemented for specific policies and directives. The need was reinforced by decisions taken at the Barcelona and Johannesburg Summits to integrate external dimensions into policy making. There is a clear ambition, for example, to integrate environmental issues into all policy domains, such as economic policy (COM(2000)576), industry (Conclusions of the Council of 29 April 1999), the single market (COM(99)263), employment (COM(97)592), agriculture (COM(1999)22) and community co-operation policy (COM(2000)264). An Integrated Assessment regime governing EU policy making has already been established. Within the context of this regime, which embraces sustainability impact assessment, all major proposals adopted by the Commission (i.e., those listed in its Annual Policy Strategy or its Work Programme as well as policies judged, in a preliminary evaluation, to have the potential for significant spill-over impacts in relation to policy objectives and domains other than those explicitly targeted) are to be subjected to extended impact assessment. In 2004, this concerns some 40 policies.

This clearly articulated demand for sustainability assessment is, however, no reason for complacency. To the contrary, several concerns need to be addressed by those on the supply-side if the potential of sustainability assessment in respect to sustainable

development and governance quality assurance is to be fully developed:

i) Currently, a proliferation of potentially incompatible assessment tools and methods jeopardises consistent sustainability assessment. Harmonised approaches based upon best practice would ensure greater consistency between EU policies as well as consistency between local, regional, national, and EU-level policies, programmes and strategies. Although a set of guiding principles for impact assessment has been issued, more stringent (and, if possible, quantitative) measures and standards are needed.

ii) Sustainability assessment today is mostly confined to the short-term, pragmatic, sectoral-policy end of its role spectrum. The EU regime of Integrated Assessment evaluates sectoral policies in relation to (some of) their wider sustainability impacts. More strategic applications in integrated sustainability policy design and assessment, however, still remain to be developed. Sustainability assessment is therefore mostly limited in current applications to delivering only a small part of its potential contribution to sustainable development and to assuring governance quality.

iii) Take-up of sustainability assessment - even in sectoral policy assessment - is far from comprehensive across jurisdictions, domains and levels of policymaking. Nor has sustainability assessment disseminated meaningfully into other spheres of decision making, for example within the private sector.

iv) The current toolkit of models and methods for sustainability assessment is inadequate for addressing actual and potential information needs. Many relevant policy questions cannot yet be addressed. Some of the major analytical deficiencies of the current toolkit are addressed in more detail below.

4. Current status of sustainability assessment

Considerable progress has already been achieved over the past two decades in the development of tools and methods that are potentially very useful for performing sustainability assessments. The field of Integrated Assessment, for example, already exists. Integrated Assessment (IA) is the science that deals with an integrated systems approach to complex societal problems embedded in a process-based context. IA aims to analyse the multiple causes and impacts of a complex problem in order to develop policy options for a strategic solution. Integrated Assessment itself is a process in which specific IA-tools form the equipment to perform the assessment. Integrated Assessment is context-specific, so both the choice of the process architecture and of the tools and methods are dependent on the substantive issues of concern and on the applications context. The IA-toolkit is already quite rich, including both analytical tools/methods (such as models, scenarios, uncertainty analyses, and risk analyses), and participatory methods (such as focus groups, policy exercises and dialogue methods). Moreover, the toolkit has been tested and proved in practical applications already. There have been many very successful applications of Integrated Assessment in such fields as acid rain and climate change, using IA-models such as RAINS and IMAGE.

The multi-dimensionality of sustainable development requires an integrated and interdisciplinary approach as is practised in the science of Integrated Assessment. In principle, Integrated Assessment is therefore a suitable generic approach to address the phenomenon of sustainable development and it is now beginning to be used to explore the analytical challenges that sustainable development presents. We can thus recognise the emergence of a new science dealing with the Integrated Assessment of Sustainable Development and can refer to this as Integrated Sustainability Assessment (ISA). ISA is a new and potentially powerful, multi-purpose approach at the interface between sustainability science and sustainability policy.

However, the current tool-kit of IA is not yet sophisticated enough to address the multi-dimensional complexity of sustainable development. The tasks of Integrated Sustainability Assessment include analysing human activities as driving forces, estimating the impacts of policies and trends on ecosystems functioning and human health, indicating critical thresholds and potential damage, setting policy-targets, developing mitigation and adaptation strategies, and process monitoring. The current IA tool-kit covers only some of the domains, dimensions, levels and scales of sustainability that are needed to accomplish these tasks. Furthermore, the current generation of IA models is based upon rather simplistic and unrealistic representations of agent behaviour. Today's integrated assessment processes and the IA-toolkit are not geared up to handle such phenomena as complexity, uncertainty, recursivity and reflexivity, which are characteristic features of sustainable

development.

5. Lessons for methodology development

In attempts made so far to develop tools for sustainability analysis, two main development approaches are discernible. Some researchers have started from a mono-disciplinary basis. Others have attempted to develop generic tools for the phenomenon of sustainable development. All efforts to date, however, have resulted in a number of common insights, which are useful for guiding future methodology development. It is now generally acknowledged that an overall generic tool, capturing the multi-dimensionality of sustainable development, is not possible. It is also acknowledged that sustainability embraces a diverse set of non-market values whose revelation requires continuing dialogue with stakeholders. Furthermore, sustainability assessment needs to be tailored for specific applications contexts, because of the wide range of policy domains and contexts.

Since no single tool or instrument can capture all stages and dimensions of sustainability it follows that a portfolio of tools is needed to support sustainability assessment processes and that an important analytical issue concerns the choice of tools and methods to be used in specific instances and how the tools, especially the quantitative models used, might be interlinked. Furthermore, the relevance of non-market values to sustainability assessment, as well as their dynamic and complex nature, implies that (un)sustainable development cannot be modelled or assessed using quantitative tools alone, but must be assessed using a combination of quantitative and qualitative tools and methods. Given the vast range of potential applications contexts and domains, models and participatory methods to support sustainability assessment in specific contexts and domains and at specific stages in assessment processes are required.

Overall, this implies the need for a flexible, hierarchical approach to performing integrated sustainability assessments and to linking together appropriate combinations of tools and methods. Integrated Sustainability Assessment therefore depends, ultimately, on having a portfolio of modular tools, which can be appropriately inter-linked, process-embedded and used in support of context-embedded assessment processes.

Other relevant insights for methodology development come from experience with using assessment tools. It is now clear that the diversity of available tools and methods - each developed from different starting positions and assumptions - is beginning to hinder efficient assessment in practical policy-making settings. Equally, the current methodological paradigm of Integrated Assessment is potentially a hindrance to the development and use of improved tools and methods better suited to address the complexity of sustainable development. Sustainable development puts new requirements on Integrated Assessment tools, in terms of trade-offs between multiple scales and multiple generations, and between socio-economic-technological and environmental processes. Although significant progress has been made over recent years toward providing analytical capacity to support sustainability assessment within the current Integrated Assessment paradigm, deficiencies and limitations of current Integrated Assessment tools have become very obvious. These include the imbalance between the socio-economic-technological dimension versus the environmental dimension, the purely rational representation of actors, the poor treatment of uncertainties and the single-scale process representation of most models.

6. A dual-track approach to developing ISA capacity

As a complex, multi-dimensional phenomenon, sustainable development has a depth and breadth which is not covered fully by the current portfolio of assessment tools and methods. New and improved tools and methods are needed that integrate the social, economic, environmental and institutional dimensions of sustainability. These are required for integrating sustainability into EU-decision processes and for securing greater cohesion and co-ordination in sectoral and cross-sectoral policy-making by highlighting conflicts and trade-offs between EU-policy objectives and by identifying opportunities for enhancing the compatibility of policy objectives. Equally, a blend of quantitative, qualitative, analytical, participatory and deliberative tools and methods is required in order to characterise the disparate sustainability dimensions of EU-policies. Tools and methods are required at different spatial scales levels and also for the shorter-term (5-10 years) and the longer term (25-50 years). Because the multitude of temporal and spatial scale levels cannot be covered by a single tool or method, multiple tools and methods are needed. Improvements in tools and methods are needed to widen the perspectives on social-system dynamics, to allow a better coupling

with actor-based models and participatory processes and to facilitate communication with non-experts. There is also a need to break from the assumptions of structural conservatism that are inherent in the current generation of quantitative models.

As already indicated, sustainability is an intergenerational phenomenon, that operates at multiple scale levels and covers socio-cultural, economic and ecological dimensions. The essential tasks for assessment are to make the tensions between these scale levels and dimensions explicit and to help in developing strategies for alleviating these. We therefore need a new generation of assessment tools, in particular, modelling tools, that can quantitatively assess the multiple dimensions of sustainable development, in terms of multiple scales, multiple domains and multiple generations. Furthermore, there is a need at the EU-level for a cross-sectoral approach to assessing sustainable development at a strategic level that involves a long-term, comprehensive assessment of EU-policy programmes against sustainability targets and criteria. In order to perform such strategic-level, cross-sectoral analyses, the new tools and methods need to be rooted in a new analytical paradigm, which is intrinsically better adapted to the essential character and features of sustainable development. The time is therefore ripe to start developing a new generation of Integrated Sustainability Assessment (ISA) tools.

However, since the development of new tools is time-consuming and costly, there is a pragmatic need in the interim to make best use of the currently available IA tool-kit. In concrete terms, this involves improving existing IA tools so that these embrace the full set of sustainability dimensions, filling critical gaps in the tools portfolio and improving the capacity for inter-linking tools so that these can be used together more easily in assessment processes. Thus, the pragmatic need to improve and inter-link existing tools to provide for more efficient and effective assessments in the near-term goes hand-in-hand with the scientific challenge to simultaneously develop a new generation of specifically-designed Integrated Sustainability Assessment tools rooted in a new and more appropriate scientific paradigm. On this basis, we can speak in terms of a dual track for methodology development and improvement efforts. Both tracks are important, both are necessary and the two can be made harmonious and mutually supportive.

7. Improving and inter-linking existing tools

The challenge in the near-term is therefore to perform Integrated Sustainability Assessment in a similar way as has been done for climate change, in particular within the framework of the IPCC, encompassing the following tasks and tools:

(i) analysing the dynamics of sustainable development, using Integrated Assessment models;

(ii) forecasting (un)sustainable trends and developments, using Integrated Assessment-models and scenarios of the future;

(iii) assessing the sustainability impact of policy options, using model-based cost-benefit and cost-effectiveness analyses;

(iv) monitoring the long-term process of sustainable development, using model-based indicators;

(v) designing the process underlying Integrated Sustainability Assessment, using participatory methods.

This can be achieved by extending and improving existing tools to incorporate all the dimensions of sustainable development and to enable them to cope better with the complexity that SD requires, and by improving the compatibility of models, especially at the model interfaces, so that different tools can be inter-linked and used in a more advanced and effective manner.

Just as important as tool development, however, will be to develop improved ways of using the new tools and methods in conjunction with each other. Interlinkage of tools is necessary to enable estimation of how policies contribute to specified sustainability targets, assessment of the distance between a future projection and specified sustainability targets, and exploration of the reasons for any gap between them. The limited level of integration between the various subsystems and the high level of abstraction of the processes as represented by current-generation IA-tools and instruments are urgent concerns.

The priority development task is to improve and inter-link quantitative tools, in particular Integrated Assessment Models (IAMs). The challenge is to use IAMs in conjunction with sustainability indicators and scenarios, and to provide them with an appropriate and adequate participatory setting. For instance, a hierarchical set of indicators might be dynamically linked to IAMs. In this way, indicators can serve as vehicles to communicate IAM results and as a basis for mapping response strategies. IAMs might also

provide scenarios with quantitative rigour and accuracy, whereas scenarios could provide communication vehicles for models, as tested in the EU-VISIONS project (Rotmans et al 2000). Existing IAMs could be used in a participatory context (as tested in the EU-ULYSSES projects, Kasemir et al 2003). Systematic uncertainty and risk analyses performed with IAMs can help in conveying the nature of the uncertainty and provide a link to different risk strategies. Possible examples of IAMs that could be used in this context are the GECs-model, the NEMESIS-model, the GEM-E3 model, the IMAGE model and the E3-EME model.

8. Developing next-generation ISA tools

To address the complexity of sustainable development, the next generation of ISA-tools, in particular the next generation of Integrated Assessment Models, should be rooted in the newly-emerging scientific paradigm of sustainability science. This incorporates insights from complex systems theory, evolutionary economics, multi-level governance and multi-agent modelling. These next-generation Integrated Assessment Models should handle multiple scale levels, in particular micro-scale dynamics, that can deal with the dynamic behaviour of actors. They should also be better equipped to handle characteristics that are intrinsic to sustainable development. The new generation of models should be better able to represent the co-evolution of subsystems and underlying driving forces, be more explorative than predictive, and be more demand (stakeholder)-oriented than supply-oriented. Models developed within the framework of the new paradigm should also be better able to support the emergence of new concepts and strategic applications of these. An example is the transition concept (Rotmans et al, 2001), which enables complex societal patterns of transitions to be analysed and unravelled in terms of time, scale and actors.

9. The process of methodology development

In order to avoid fragmentation and a proliferation of incompatible assessment approaches, a common set of principles is needed both for developing ISA-tools and for performing ISAs. Methodology development should start from a clear understanding of both the current status of sustainability assessment and its pattern of use in relation to different domains and contexts of application, including, especially, the important institutional factors that play a key role at the science-policy interface. This requires an understanding of the complex mechanisms that shape policy-making, including fundamental questions of how policy preferences are formed, and what characterises the decision-making context in terms of actors, interests and information needs. Also important, is to have a clear and ambitious future vision of the potential role of ISA as a key instrument in support of decision making and sustainable development. This contextualisation is critical for co-ordinating future work on tools and methodology development and for identifying priorities, criteria and principles that will need to be integrated into methodology development if fragmentation is to be avoided and if ISA is to fulfil its potential.

Both the process of developing new and improved ISA tools and the process of Integrated Sustainability Assessment itself should be viewed as adaptive and iterative, not least because of the reflexive and recursive nature of sustainability assessment as an interactive learning process. As capacities improve through learning-by-doing on both the demand and supply sides of integrated sustainability assessment, increasingly more strategic analyses are likely to be requested and increasingly more appropriate tools and methods will become available to meet information needs and to support the development of integrated sustainability policies. Thus, ISA tool and methods should be developed, tested and refined through a process of co-production with stakeholders at the science-policy interface using applied case-studies of policy relevance. Both the tools and the ways of using them must be tested and refined through multiple case studies (for example, through place-based and chain-based analyses) involving actors and stakeholders. Engaging users and stakeholders throughout the development and application of ISA tools and methods will help build competencies and capacities as well as encourage wider take-up of integrated sustainability assessment in policy processes.

10. Conclusion

The need to improve decision support capacity to policy makers in the short term together with the scientific challenge of improving the processes and tools of strategic sustainability assessment in the longer term suggest the need for a dual-track approach. Effort should be focused on making better use

of the existing portfolio of available tools, so that these are used as effectively and efficiently as possible. Better use implies that quantitative tools and qualitative methods are combined in assessment processes and that quantitative tools, such as models of relevant systems and subsystems, are inter-linked. The need to provide for integrated quantitative analyses will demand modifications to provide greater compatibility and consistency in model assumptions and data as well as improvements at the interfaces between models. Simultaneously, effort should be devoted to accelerating development of the next generation of ISA tools and methods using promising concepts, such as those rooted in the emerging paradigms of complexity, evolutionary economics, and co-evolutionary dynamics that underpin sustainability science. Methodology development and application of new and improved methods in actual sustainability assessment processes should be undertaken jointly by those on both the demand and supply sides of sustainability assessment. A wider take-up of sustainability assessment based upon improved tools, consistently used and appropriately process- and context- embedded, could contribute significantly both to sustainable development and to improving governance quality and transparency.

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