

An adaptive indicator framework for monitoring regional sustainable development: a case study of the INSURE project in Limburg, The Netherlands

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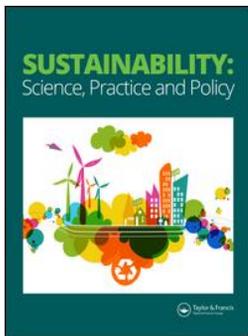
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ARTICLE

An adaptive indicator framework for monitoring regional sustainable development: a case study of the INSURE project in Limburg, The Netherlands

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Indicators by themselves tell us little about how well a system is progressing in relation to the goal of sustainability. Especially at the regional level, existing indicator frameworks do not typically permit the inclusion of relevant region-specific information. Furthermore, they do not provide comprehensive information on overall system sustainability. The real challenge is not to identify indicators—there are hundreds of good lists—but to seek out the best way to put all of them to work. The INSURE project, carried out in four case-study regions in Europe (including the Limburg region of The Netherlands), attempted to develop an adaptive indicator framework for integrated monitoring of sustainable development. During the project, it became increasingly clear that indicators are not only more meaningful when viewed within the context of the whole system, but also that science and policy play different, but complementary, roles. This article discusses the challenges and the lessons learned during the Limburg project.

KEYWORDS: sustainable development, macro-scale indicators, regional planning, stakeholders, public policy, sociopolitical aspects

Introduction

Because the results of sustainable development efforts often only become visible after a long period of time, it is necessary to monitor the implementation of processes as they unfold. Continuous appraisal helps to make progress visible and to steer processes in the appropriate direction. However, a meaningful assessment of sustainable development encounters problems regarding the choice of indicators and the integration and interpretation of information. In general, indicators by themselves tell us little about how well a system is doing in relation to the goal of sustainability or how it will respond to certain policy initiatives. There is a vast range of published criteria for measuring and evaluating sustainable development, but most of them are geared to the global or national level (Bühler-Natour & Herzog, 1999; Graymore et al. 2008). At the national level, indicator sets include the framework of the United Nations Commission for Sustainable Development (UNCSD) and the European Union (EU) sustainable development indicator framework (European Commission, 2005; United Nations, 2007). Sustainability indicators have been developed for a variety of purposes, such as policy reform, socioeconomic assessment of rural areas, benchmarking, justification of public expenditures, support for land stewardship, and inter-generational equity (King et al. 2000). They have

been applied at different geographic scales, such as countries, regions, and cities (Graymore et al. 2008). However, several authors state that measuring sustainable development at the national level, or with national-level data, might fail to capture critical issues at the regional level (Bühler-Natour & Herzog, 1999; Herrera-Ulloa et al. 2003; Reed et al. 2006). Graymore et al. (2008) show that various methods reported to be useful at different levels of spatial detail—including the regional—are not completely effective at the regional scale due to data limitations and a top-down definition of sustainable development.

In terms of geographic scale, regions have an optimal size for successfully implementing sustainable development: small enough to be of direct interest to residents and large enough to possess critical mass for creative solutions (Zilahy & Huisingsh, 2009). A region should be seen here as an area smaller than a nation that has an identity demarcated by boundaries (an administrative entity) or identified by relatively homogeneous economic, social, or landscape characteristics. In this sense, a region can cross borders (e.g., the Euroregion Meuse-Rhine includes Belgian, Dutch, and German provinces and is an area with a shared history and similar economic interests). Graymore et al. (2008) state that the regional scale is:

[T]he most appropriate for natural resource management and for progressing sustainability, because it is at this scale where ecological functioning and human activities most intensely interact and where a balance between the two is critical to studying and resolving natural resource and sustainability issues. It is also at this scale where the most difference can be made by decision-making and community choice.

Furthermore, Graymore et al. (2008) contend that the regional level provides the greatest opportunity for local governments to work together with their constituent communities toward sustainable development. Pointing out that values may differ across regions, Stevenson & Ball (1998) propose an approach to measuring the sustainability of materials that allows for this variability instead of applying generic standards. McManus (2008) contends that a regional unit of analysis incorporates processes that go beyond the regional level. For example, in the case of the Upper Hunter region of Australia, the coal-mining, horse, and wine industries all affect regional sustainability, but are also part of national and global processes. Regional assessments should incorporate such considerations, recognizing that “regional sustainable development is a relative concept and is a process of becoming” (McManus, 2008). A danger of selecting indicators without taking into account the context or a common vision is that they may not provide useful insights about sustainability.

Numerous methods for identifying indicators exist, as well as a variety of criteria for selecting indicators. Indicators are often identified by means of participatory processes (e.g., Bell & Morse, 2004; Mickwitz & Melanen, 2009), and this process is often combined with a literature review of available indicator sets (Bühler-Natour & Herzog, 1999; Kelly & Moles, 2002; Wallis, 2006; Putzhuber & Hasenauer, 2010). It is also common for researchers themselves to select the relevant indicators (Bouman et al. 1999; Herrera-Ulloa et al. 2003; Viglizzo et al. 2003). Criteria used to decide on indicators include objectivity and ease of use (Reed et al. 2006), the Bellagio Principles¹ (Ramos & Caeiro, 2009), availability of time series, and inclusion in official government-formulated sustainable development indicator (SDI)

¹ The Bellagio Principles serve as guidelines for the entire assessment process, including the choice and design of indicators, their interpretation, and the communication of results. They are inter-related and should be applied as a complete set and are intended to start and improve assessment activities of community groups, nongovernmental organizations, corporations, national governments, and international institutions. See http://www.iisd.org/measure/principles/progress/bellagio_full.asp.

lists (Herrera-Ulloa et al. 2003). Further criteria are simplicity, scope, quantification, sensitivity, and timeliness (Kelly & Moles, 2002). Spangenberg (2002) suggests that indicators should show the status of a domain, as well as interlinkages among domains. Another aspect of indicators is the weight factor that is assigned to them. Again, a multitude of approaches exists. Some authors consider all indicators of equal importance in their sustainability reports (European Commission, 2005; 2007; Provincie Limburg (België), 2006; IISD & JRC, 2009), while other researchers use participatory processes for ranking the indicators to identify the most important ones for a given region (Kelly & Moles, 2002; Mickwitz & Melanen, 2009). It is also common to use regression analysis (Putzhuber & Hasenauer, 2010) to seek out weakly correlated indicators (Herrera-Ulloa et al. 2003) or to rely on coefficient-generating tools and models (Bouman et al. 1999).

In summary, there are different ways to identify indicators, to determine selection criteria, and to assess relative importance. Moreover, measuring sustainable development is not only an objective issue, but, unavoidably, a political one. Taking into account the diverse meanings of sustainable development and its specific interpretations in various regions, it is often difficult to identify indicators for carrying out sustainability assessments. Indeed, Reed et al. (2006) observe that indicator selection is just one step in a sequence that starts with identification of the context and constituent visions and strategies.

This article discusses an adaptive indicator framework for measuring regional sustainable development. It is adaptive in the sense that it allows for the inclusion of regional characteristics and different methods for selecting indicators. This so-called INSURE method, developed to find meaningful indicators at the regional level, was implemented in four case-study regions: Antalya (Turkey), Limburg (The Netherlands), Lombardy (Italy), and Pardubice (Czech Republic).² Instead of just measuring the “symptoms of unsustainability” through individual sustainable development indicators, INSURE sought to get to the “causes” with a more fundamental understanding of the region as a system. During the project it became increasingly apparent that indicators become more meaningful with this approach. The real challenge is not to identify indicators, but to look for the optimal way to combine them to provide a picture of regional sustainable development (cf. Grosskurth & Rotmans, 2005; Wiek & Binder, 2005).

² Details on INSURE (Flexible Framework for Indicators for Sustainability in Regions, Using System Dynamics Modelling) are at <http://www.icis.unimaas.nl/projects/insure>. The research program was active between 2004 and 2007.

The flexible framework inherent in INSURE puts the indicators into perspective with the aim of coming to a regional assessment. This article discusses the challenges we faced (some of which remain unresolved) and the different roles and actors involved in carrying out this task.

The next section discusses the normative aspects of measuring sustainable development and the roles of policy makers and scientists in the steps of the monitoring process (defining the perspective on sustainable development is an especially normative issue). The role of indicator frameworks as an expression of the political view on sustainable development is then discussed. The importance of indicator frameworks and the roles of policy and science are further explored in the sustainability assessment of the Limburg region in The Netherlands. Based on the outcomes, several challenges for monitoring are discussed and conclusions are drawn that give some insight into assessing sustainable development at the regional level.

Measuring Sustainable Development: A Normative Issue

The search for effective sustainability indicators continues to be framed primarily as a technical or scientific problem rather than a political challenge. Although science clearly is needed to develop understanding of the underlying systems, states, and processes that indicators reflect, the role of scientists in *selecting* policy-relevant indicators is less clear. McCool & Stankey (2004) observe that the actors involved in identifying indicators are making choices at the interface of science and policy. These authors also note that indicators are often selected based on our *ability* to measure a particular phenomenon (a technical issue) instead of on the *need* to measure it (a normative issue).

The field of sustainability science generally recognizes that scientists and policy makers are part of a heterogeneous network that has to manage different kinds of knowledge (cf. Reitan, 2005; Martens, 2006; IHDP, 2008; Regeer et al. 2009). The different styles of knowledge creation in these domains must be integrated to bridge the gaps among science, practice, and policy. With respect to indicators, we also encounter a need for knowledge integration. The social and normative question “what is to be sustained” should always precede the search for indicators (van Zeijl-Rozema et al. 2008). Without societal agreement on this point, it is impossible to identify relevant and valid indicators.

McCool & Stankey (2004) and Reed et al. (2006) contend that establishing sustainability goals should be the starting point for measuring sustainable

development. However, when scientists intervene on what should be sustained, they move into the realm of decision making. As scientists are usually not elected through democratic processes, they should be extremely cautious about setting sustainability goals and standards. Sustainability should ideally be determined by what the community values within the broad framework of the triple bottom line (people, planet, profit) or the Brundtland definition (Stevenson & Ball, 1998; Reed et al. 2006; Wallis, 2006). Tools to assess progress must be developed within the context of the local landscape (Wallis, 2006). Sustainable development is not a single, well-defined concept; rather, various positions and perspectives exist. Whichever view is propagated, it entails a normative choice (van Zeijl-Rozema et al. 2008).

After establishing sustainability goals, the next step in the process of measuring sustainable development is the selection of appropriate indicators. If the goals are clear, experts can typically find indicators that show progress toward them. However, if the goals are ambiguous, the selection of indicators will reflect the selectors’ worldview and emphasize certain areas while neglecting others, regardless of policy priorities.

The last step is the interpretation of results. Here, again, much depends on the setting of goals, as well as on the criteria. Without criteria it becomes extremely difficult to judge whether a development is sustainable or unsustainable. A distinction is therefore evident between the roles of science, on the one hand, and policy and society, on the other hand. A linkage between the two is required and the question becomes how to realize it.

Reed et al. (2006) distinguish four steps for developing and applying sustainability indicators. The corresponding linkages to science and policy, as we see it, are mentioned in brackets:

1. Determine the context; identify the key stakeholders and define the system or area relevant to the problem being studied [science/policy].
2. Establish sustainability goals and strategies [policy].
3. Identify, evaluate, and select indicators (where evaluation refers not to interpretation of the data, but rather to assessment of the representativeness of the indicators) [science].
4. Collect the data to monitor progress [science/policy].

McCool & Stankey (2004) indicate that interaction and participation of actors from science and society—and thus coproduction of knowledge—are essential for regional assessments of sustainable development. They observe that scientists have impor-

tant roles to play, such as clarified problem framing, system description, system measurement, display of outcomes, and interpretation of implications and options. The public and policy makers are responsible for providing clear sustainability goals to support and enforce monitoring, to evaluate monitoring data, and to implement policies leading to sustainability. In their words:

[T]he respective roles are interdependent, essential, and mutually informing, and the processes used in implementing indicator information are iterative, adaptive, and ongoing, incorporating new information as society learns how to better measure and monitor important system information (McCool & Stankey, 2004).

If we combine the two frameworks, the relationships depicted in Figure 1 emerge. In this illustration, the dark blue signifies the role of policy and the light orange the role of science. The rectangles, connected by arrows, denote the steps in the process of assessing sustainable development. For each step, the roles of actors from policy and science are indicated.

It merits noting that the various roles are not strictly separated, but are instead fluid. To conduct a proper monitoring exercise, it is important to be aware of the roles of different actors, the steps in the process, and the degree of complementarity among them. Such an exercise is a complex affair that re-

quires the knowledge and involvement of numerous stakeholders throughout the process

Using Indicator Frameworks

Numerous organizations such as the EU and the UNCSO have developed indicator frameworks on sustainable development, each reflecting the key issues for a particular geographic area. For instance, the EU indicator framework is set up to monitor the implementation of the EU Sustainable Development Strategy at the national level (European Commission, 2005). The UNCSO Indicators of Sustainable Development aim to monitor the national implementation of Agenda 21, the Johannesburg Plan of Implementation, and the Millennium Development Goals (United Nations, 2007). In other words, an indicator framework generally addresses a certain institutional perspective on sustainable development and a set of political priorities for action and focuses on a certain spatial scale. Each framework is an expression of a “political agenda that identifies the priority elements of a specific sustainability policy” (INSURE, 2007). Moreover, indicator frameworks are not always transferable to other parts of the world, to other perspectives on sustainable development, or to different scale levels. It is therefore important to be aware of the purpose for which a specific indicator framework is being designed.

In the INSURE project, we used the EU indicator framework as a political expression of sustainable development. The aim in this case was to develop a method that included regional characteristics in an indicator framework in such a way that the relative importance of each indicator within the regional system was made visible. This approach permitted a comprehensive picture of the region’s dynamics, including its strengths and weaknesses. The EU framework provided the necessary context and goals on sustainable development. Because we used this particular scheme, it is worthwhile to briefly highlight its history and focus.

To appreciate the emergence of the EU indicator framework, we need to go back to the introduction of sustainable development as an explicit objective of the European Community as it was expressed in the Single European Act of 1987. Over the subsequent two decades, many regional meetings have taken place to foster a political commitment toward sustainability. At the Gothenburg Summit in 2001, EU member states agreed that the economic, social, and environmental effects of all policies should be examined in a coordinated way and taken into account in decision making. The European Council identified ten priority areas for sustainable development as general guidance for policy measurement and develop-

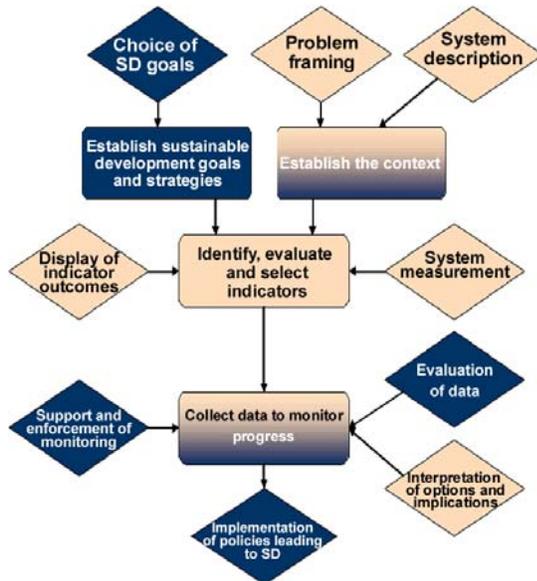


Figure 1 The role of policy and science in the various stages of monitoring sustainable development (policy in dark blue, science in light orange, steps in the process in rectangles, roles of actors in diamonds).

ment.³ This set of concerns is reflected in the EU sustainable development indicator scheme: (1) economic development; (2) poverty and social exclusion; (3) aging society; (4) public health; (5) climate change and energy; (6) production and consumption patterns; (7) management of natural resources; (8) transportation; (9) good governance; and (10) global partnerships (European Commission, 2004).

The INSURE Method: Lessons from Limburg

As mentioned above, the main goal of the INSURE project was to find region-specific indicators and to combine them in such a way that they could provide an integrated view of regional sustainability. We used the EU indicator framework to provide the political context and vision on sustainable development and to establish a basis for comparison for four case studies. However, the EU framework is structured in a hierarchical way with themes, sub-themes, headline indicators, and so forth. We wanted to obtain a meaningful picture of sustainability at the regional level, with indicators characteristic of the region. It was obvious that the EU framework would not always match regional features. This situation not only implied the use of regionally collected data for the predefined indicators, it also meant using different indicators altogether for the themes in the framework.

One could reasonably ask why we went through this difficult maneuver to measure regional sustainable development. Why not develop a customized framework for each case study? First, comparability among case studies would have been impossible with different frameworks incorporating inconsistent priorities and goals for each region. Second, the point was not to design a framework for each region, but to provide a generic approach for measuring sustainable development without following the standard approach of predefining a universal indicator set. Finally, the aim was not to design the context and goals for each region, but to show that defining them is an important step for measuring sustainable development. The project operationalized the context and goal-setting step by using an existing political expression of sustainable development.

We next conducted a qualitative systems analysis (QSA) of the region to establish the context. A broad regional picture was thus obtained using the EU framework as a filter for detailed analysis. It pointed to those areas that were important for the EU's sustainability goals. It should be noted that a different framework could have conceivably focused on other elements of the regional system. To see how this situation could have occurred, just imagine two different perspectives on sustainable development: an ecological perspective that places great emphasis on regional carrying capacity and a well-being perspective that stresses social health. Within each view, different parts of the regional system would become more or less important.

For those areas highlighted within the region, indicators were sought. A second requirement was that the indicator needed to provide insight into the state of an *influential* element in the regional analysis. Influential means here an element that has a notable impact within the system or, in other words, that is an important driving force. For technical details on determining influence, readers are encouraged to consult the INSURE website. The reason behind this second requirement was to enable us to evaluate the indicators in relation to each other. The influence within the system was used to weight the indicators so that we could judge, for example, the relative importance of congestion in relation to decreasing agricultural land use (Figure 2).

Essential for the method described here is the interpretation of an indicator *within the system*. It is not uncommon to encounter long lists of indicators that tell us nothing about their respective roles and functions in sustainable development (Provincie Limburg, 2005a; Provincie Limburg (België), 2006). For example, Eurostat, the statistical bureau of the European Commission, struggled in its 2007 progress report with how to derive an overall picture of progress toward sustainable development using eleven headline indicators (European Commission, 2007).⁴ In another case, the UNCSO guidelines on indicators recommended using simple symbols suggesting forward or backward movement on each element to communicate the direction of progress on sustainable development in a particular country (United Nations, 2007). However, neither the European Commission nor the United Nations discusses how individual indicator values might provide a

³ The European Council comprises the heads of state or government of the member states belonging to the European Union and the President of the Commission. It came into being in 1974 and was given formal status by the Single European Act. Its members are assisted by the respective ministers for foreign affairs and by a member of the Commission. Since 2000, in accordance with the Lisbon Strategy, the European Council addresses economic, social, and environmental issues (see http://europa.eu/european-council/index_en.htm).

⁴ The European Commission is the EU's executive body. It represents and upholds the interests of Europe as a whole, drafts proposals for new European laws, and manages the day-to-day business of implementing EU policies and spending EU funds. The Commission also makes sure that everyone abides by European treaties and laws. See http://europa.eu/abc/panorama/howorganised/index_en.htm.

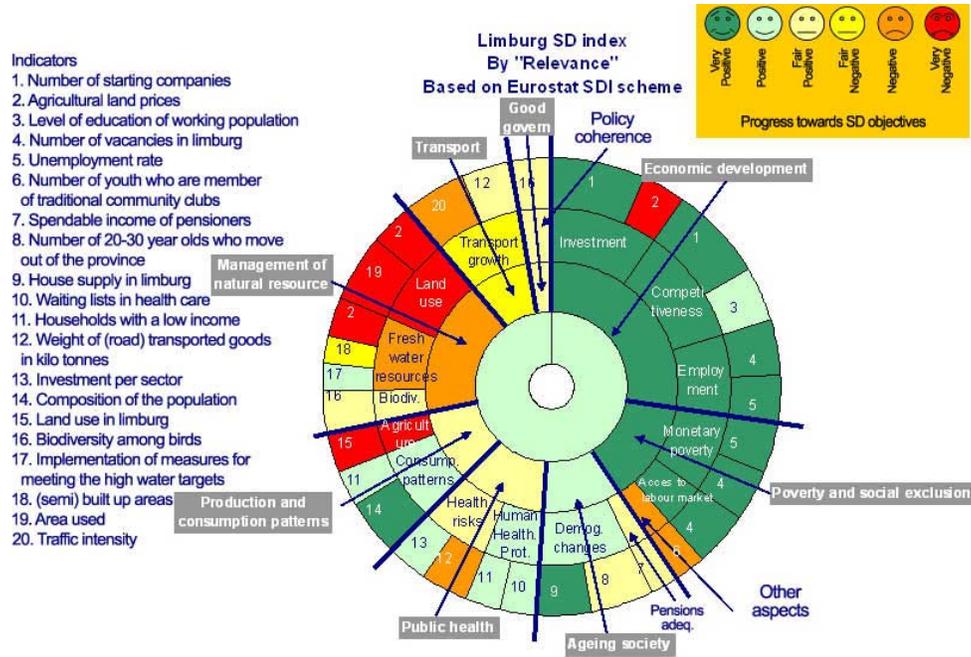


Figure 3 The dashboard overview of sustainable development in Limburg for the EU-SDI framework.

erally positive. However, policy makers should devote attention to the areas highlighted in the outer ring where there are signals of specific problems. A system analysis of the region can provide further insight into these underlying dynamics. In this case, the framework clearly focuses on certain issues considered problematic for sustainable development within the European context, such as an ageing society or poverty and social exclusion.

A Regional Framework

The previous section described how Limburg is doing with respect to sustainable development from an EU perspective. However, some important elements from the general regional systems analysis could not be accommodated in the EU framework (e.g., transboundary drug dealers, cultural identity, and architectural and cultural heritage). This situation means that certain facets were not considered important for that specific (political) view on sustainable development, although they were important for the region (based on the QSA results). The EU priorities were not necessarily regional priorities. Similarly, some themes of the EU indicator framework were not relevant for Limburg and were disregarded. For instance, the condition of the marine environment did not apply as Limburg is landlocked. This observation highlights why, in terms of some criteria, the EU framework is inappropriate for conducting a sustainability assessment for the region.

Accordingly, the regional administration wanted to conduct a sustainability assessment from a perspective that would enable it to fulfill a biennial monitoring requirement. An expert group consisting of provincial administration staff was asked to conduct an assessment using the INSURE method. Completing this task required the use of a meaningful indicator framework that could be adapted to a regional scale and that was made or adapted specifically for Limburg. A regional framework can be a tool to follow up on progress toward the current political agenda on regional sustainability or a set of particular regional concerns. However, comparability among the development of different regions dramatically decreases when a regional framework is used because every region introduces into the framework its own idiosyncratic priorities and key issues (INSURE, 2007).

A regional framework of sustainability indicators did not exist for Limburg, so one had to be designed. When we started developing this framework within the context of the biennial exercise of monitoring the status of the province, the Limburgmonitor (Provincie Limburg, 2007b), it became clear that policy makers lacked a long-term vision on regional sustainable development. On the basis of various policy documents, it was possible at best to assemble a partial vision. According to the provincial administration:

[S]ustainable development has in theory five dimensions: ecological, economic, socio-cultural aspects, long-term effects and effects elsewhere. Furthermore...development must take place in such a way that the value of each form of capital increases and that the increase of one type of capital does not reduce the value of the other capitals (Provincie Limburg, 2005c) (translation by authors).

A self-evaluation by the province of its sustainability policy (2005–2007) stated that measurable goals and related indicators had not been identified because the program emerged only during the government period of 2003–2007. Therefore, regional officials could not draw any conclusions on the policy's success (Provincie Limburg, 2007c). The current coalition agreement, a document that describes the overall political priorities for the period 2007–2011, explicitly recognizes the first three domains cited above (i.e., ecology, economy, and society) and their interconnectedness and regards sustainable development as an important pathway (Provincie Limburg, 2007a). However, sustainable development is not made concrete and is not supported by clear goals.

As a consequence, the expert group working on regional monitoring did not want to interfere with what its members saw as a role for policy makers by setting their own priorities for sustainable development in Limburg. Therefore, the regional framework remained rather indistinct and was based simply on the three pillars of sustainable development: society, economy, and ecology. Furthermore, the absence of sustainability goals and criteria for interpretation became a major barrier to conducting a successful sustainability assessment. This problem could not be overcome by using an expert group that had no political mandate for defining sustainable development in this regional context because it was neither representative of the population nor an elected body with delegated powers from the residents of Limburg. Due to the absence of policy-making input into the process, problems arose at several stages (see Figure 1).

This project made clear that at all stages of measuring sustainable development, the involvement and cooperation of relevant policy makers and technical experts is essential. With hindsight, we must admit that enhanced cooperation among these participants from the beginning would likely have led to a more meaningful assessment.

Discussion

The previous sections have demonstrated the importance of linking science and technical expertise with policy in integrated sustainability assessment and the problems that arise if these roles are not effectively fulfilled. However, several questions remain. What recourse is there when a vision of sustainable development is not available? Is an indicator framework truly an expression of a political vision of sustainable development? Can a systemic analysis be regarded as neutral, or is it also an expression of a certain vision? And to what extent should stakeholders be involved? The following sections consider each of these questions in turn.

Missing Vision

Without a vision, an effective statement on sustainable development is hard to articulate. To say something meaningful on this subject with respect to Limburg, it is first necessary for the government or other representative body to provide such a viewpoint. Once the goals have been made explicit, it is possible to start to measure the distance that needs to be travelled. However, as Reed et al. (2006) mention, most often indicator exercises start with the identification of indicators. For Limburg, the EU sustainable indicator framework provided sustainability goals, but regional sustainable development goals were lacking. With good reason, the experts did not want to take on the role of policy makers in setting priorities for the region with respect to sustainable development. We therefore employed a rather simple, indistinct vision of sustainable development, the three-pillar approach, which is so common and uncontroversial that the expert group deemed everyone could live with it. But when deciding on the logic of what was advantageous or disadvantageous for sustainable development, we ran into problems. The three-pillar approach is so general that it is open to multiple interpretations. As a result, we had difficulty discerning a regionally appropriate set of indicators, demonstrating that a sustainable development vision and goals are extremely important.

Neutral Indicator Framework?

In our research, we have used the EU indicator framework of sustainable development as an expression of a European vision of sustainable development. But is this projection really a policy-based viewpoint, or rather a framework conceived by experts based on their ideas of sustainable development? If we read McCool & Stankey (2004) carefully, their stance is that frequently the search for indicators is an *ad hoc* process, hardly related to any framework. Therefore, when using an existing indi-

cator framework, it is legitimate to ask who created it and whether policy makers have endorsed it. If it has received such validation, we can assume that it indeed fits policy makers' contemporary ideas of sustainability. In the case of the EU, the European Commission has adopted this framework.⁵ Steinbuka & Wolff (2007) state that

[T]he list of [sustainable development] indicators itself is not defined, although it is foreseen that a limited set of indicators could be adopted by the European Council by the end of 2007. This solution was preferred by most stakeholders, as it avoids freezing a list of indicators, and allows more flexibility in its improvement and development over time.

As official EU monitoring reports using this framework appear regularly, we can assume some kind of agreement that it provides an appropriate way to assess sustainable development that is in line with EU policy objectives. However, we can also think of scenarios where policy makers have commandeered scientists and other experts to build indicator frameworks and have simultaneously delegated to them the role of defining a vision of sustainable development. We have personally fielded comments that, as scientists or other experts, we should be able to define sustainable development. However, if we review existing literature, it is clear that numerous definitions exist (cf. Parris & Kates, 2003; Robinson, 2004; Burger, 2006; Sneddon et al. 2006).

It is therefore safe to say that sustainable development is a normative concept and not an issue that can be defined by science (van Zeijl-Rozema et al. 2008). Science can help in formulating the vision by showing how certain ideas might be in conflict or by formulating scenarios of possible developments. However, it is up to society, represented by elected politicians and stakeholder groups, to decide on a broad vision of sustainable development and the sustainability of the various pathways. Of course, scientists can provide theoretical models and empirically sound methodologies. In addition, scientists have vital roles to play in supplying intellectual and conceptual frameworks along with critical and analytical perspectives. They can also offer leadership in partnerships as independent facilitators and mediators; assure transparency, credibility, and robustness to sustainable development processes; provide technical expertise; supply knowledge about data sources and their use; and afford access to international networks

⁵ See <http://epp.eurostat.ec.europa.eu/portal/page/portal/sdi/introduction>.

(Mickwitz & Melanen, 2009; Ramos, 2009; Zilahy & Huisingsh, 2009; Zilahy et al. 2009).

Systemic Analysis and Vision on Sustainable Development?

We also inquire about the extent to which a systemic analysis incorporates a hidden vision of sustainable development. The description used for Limburg was formulated in two different ways: through a discourse analysis and by means of an expert group. Each mode resulted in a different description. This variation does not pose a problem if there is clear acknowledgement which group described the system and an understanding of possible biases. For instance, the discourse analysis was based on policy documents so the prevailing political view will be reflected in the system description. The expert group was restricted to staff of the provincial administration. Although this was a multisector group, it was not a multistakeholder assemblage of people. The knowledge and worldviews of the participants determined the system description and therefore gave shape to the systems analysis. The analysis will reflect their ideas about what facilitates sustainable development and what obstructs it. However, ensuring the participation of a multidisciplinary team, preferably from different stakeholder groups (e.g., state, market, civil society), will help to form a general idea of the system. A typical political view, in contrast, will pinpoint several areas for action and leave out others. In conclusion, a systemic analysis is by no means objective, but it forms an impression of a system at a certain scale.

Stakeholder Involvement

As was mentioned earlier, sustainable development monitors should include representatives of state, market, and civil society. The composition of these stakeholder groups might differ at various stages in the process because different roles have to be fulfilled at each phase (Figure 1). An essential aspect of the participation process is that stakeholders view their involvement as making a difference because otherwise there is no incentive for them to participate (Pirk, 2002). It is also essential to clarify from the beginning what issues are under consideration, who will make the final decisions, and why and how stakeholders are involved (National Marine Protected Areas Center, 2004). In the INSURE project, we were developing a method and finding our way in an experimental setting. In such a process, stakeholders might feel lost or lose interest, as we encountered at an earlier stage with staff at the provincial administration of Limburg. With the insights gained during this project and experience acquired deploying this method, we would likely be able to organize a more

meaningful participatory monitoring process that follows more closely the guidance of Figure 1.

Conclusion

The measurement of regional sustainable development requires several elements: a capacity for flexibility that includes a set of region-specific characteristics, a proper system description, and a vision of sustainable development that determines regional priorities. Once these prerequisites are in place, it becomes possible to assess regional sustainability. From this study, we can conclude that a systems analysis from a sustainability perspective is different from an indicator framework that points at political priorities for sustainable development. However, it is necessary to draw on the systemic view to determine relationships among indicators and their relative importance in the system. It is also important to incorporate the political view to provide the context for deciding what is to be measured and how it should be interpreted.

Based on the results of the Limburg case study, we advance six summary conclusions. First, it is important to link science and policy throughout the whole assessment process. Scientists and policy makers have different roles to play and they contribute different insights (see Figure 1). An assessment carried out by only one group will lead to problems. In the case of an exclusive scientists/experts-run assessment, the normative aspect and social representativeness of sustainable development will be understated. In a policy maker/society-run assessment the transparency, credibility, and robustness of methods and data collection might not be adequately safeguarded (McCool & Stankey, 2004).

Second, the leader of the assessment should always deploy a multidisciplinary team, preferably from different stakeholder groups (e.g., state, market, civil society) to formulate a general overview of the system. These three major groups play different roles within the region and are needed to design general understanding of sustainability and the regional dynamics. The composition of the team might have to change at various points in the overall process.

Third, the organizers should make explicit a sustainable development vision for the assessment. Until agreement is reached on what it is that should be sustained—by government or, ideally, by participation of (representatives of) the region's citizenry—it is impossible to identify relevant and valid indicators. In the absence of structures to establish such a vision, the preparation of a satisfactory assessment becomes extremely difficult.

Fourth, the sustainable development filter, or perspective, used to analyze data has a large impact

on the results of the assessment. Related to this point, it is vital to use an indicator framework suited to the purposes of the assessment, to understand what the indicator framework measures, and to be aware of the sustainability perspective used, as this will lead to different priorities for measurement and thus alter results.

Fifth, it is important to relate indicator results to sustainability goals and to ensure that the results are interpreted within the context of the system. An indicator just indicates. An indicator becomes meaningful only when it is seen in the light of a norm, a threshold, or a criterion for analysis. But even under these circumstances, an indicator in isolation does not provide information about sustainability. It is only by relating a particular indicator to other measures and evaluating its importance within the system that we can make a meaningful sustainability assessment.

Finally, when conducting an assessment decision makers should give attention to negative results even if the overall picture is positive. The dashboard view demonstrates how a positive trend at a higher aggregation level could hide negative trends at lower levels. These are signals of underlying sustainability problems and deserve attention. Furthermore, it should be kept in mind that the dashboard shows trends, not the divergence between the current situation and the desired situation. It would be better to show this discrepancy. However, the desired future is largely undefined in the cases of both the EU and the regions, which means only the current situation can be shown.

The INSURE project sought to design a generic framework for determining the sustainability of a region while allowing flexibility to include regional characteristics. The work done in Limburg demonstrates that scientists/experts and policy makers can feasibly be involved in the process. Furthermore, to make a meaningful sustainability assessment it is crucial to create links between the political/social sustainable development vision and the scientific understanding.

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References

- Bell, S. & Morse, S. 2004. Experiences with sustainability indicators and stakeholder participation: a case study relating to a "Blue Plan" project in Malta. *Sustainable Development* 12(1):1–14.
- Bouman, B., Jansen, H., Schipper, R., Nieuwenhuys, A., Hengsdijk, H., & Bouma, J. 1999. A framework for integrated biophysical and economic land use analysis at different scales. *Agriculture, Ecosystems & Environment* 75(1–2):55–73.
- Bühler-Natour, C. & Herzog, F. 1999. Criteria for sustainability and their application at a regional level: the case of clearing islands in the Dübener Heide nature park (Eastern Germany). *Landscape and Urban Planning* 46(1–3):51–62.
- Burger, P. 2006. *Why Any Substantial Definition of Sustainability Must Fail—and Why This Is a Good, Not A Bad Story*. The 12th Annual International Sustainable Development Research Conference. April 6–8. The Centre of Urban Planning and Environmental Management, Hong Kong.
- European Commission. 2004. *EU Member State experiences with sustainable development indicators*. Eurostat No. KS-AU-04-001. Luxembourg: Commission of the European Communities.
- European Commission. 2005. *Sustainable Development Indicators to Monitor the Implementation of the EU Sustainable Development Strategy*. Brussels: Commission of the European Communities.
- European Commission. 2007. *Measuring Progress Towards a More Sustainable Europe*. Eurostat No. KS-77-07-115-EN-N. Luxembourg: Commission of the European Communities.
- Graymore, M., Sipe, N., & Rickson, R. 2008. Regional sustainability: how useful are current tools of sustainability assessment at the regional scale? *Ecological Economics* 67(3):362–372.
- Grosskurth, J. & Rotmans, J. 2005. The scene model: getting a grip on sustainable development in policy making. *Environment, Development and Sustainability* 7(1):135–151.
- Herrera-Ulloa, A., Charles, A., Lluich-Cota, S., Ramirez-Aguirre, H., Hernandez-Vazquez, S., & Ortega-Rubio, A. 2003. A regional-scale sustainable development index: the case of Baja California Sur, Mexico. *International Journal of Sustainable Development and World Ecology* 10(4):353–360.
- INSURE. 2007. *Guidelines to Develop a S-Indicator*. Work Package 4. Maastricht: International Centre for Integrated assessment and Sustainable development, Maastricht University. http://www.icis.unimaas.nl/downloads/insure/GUIDE_LINES/INSURE%20indicator%20guideline%20final%20feb%202007.pdf.
- International Institute for Sustainable Development (IISD) & Joint Research Center of the European Commission (JRC). 2009. *The Millennium Development Goals Dashboard*. <http://esl.jrc.it/dcl/>. February 3, 2010.
- International Human Dimensions Programme (IHDP). 2008. *Knowledge and Social Learning for Societal Change and Sustainability: Developing a New Cross-Cutting Research Theme for IHDP*. Bonn: IHDP Secretariat. <http://www.ihdp.unu.edu/file/public/Knowledge...+Concept+Note>.
- Kelly, R. & Moles, R. 2002. The development of Local Agenda 21 in the mid-west region of Ireland: a case study in interactive research and indicator development. *Journal of Environmental Planning and Management* 45(6):889–912.
- King, C., Gunton, J., Freebairn, D., Coutts, J., & Webb, I. 2000. The sustainability indicator industry: where to from here? A focus group study to explore the potential of farmer participation in the development of indicators. *Australian Journal of Experimental Agriculture* 40(4):631–642.
- Martens, P. 2006. Sustainability: science or fiction? *Sustainability: Science, Practice, & Policy* 2(1):36–41. <http://ejournal.nbio.org/archives/vol2iss1/communityessay.martens.html>.
- McCool, S. & Stankey, G. 2004. Indicators of sustainability: challenges and opportunities at the interface of science and policy. *Environmental Management* 33(3):294–305.
- McManus, P. 2008. Mines, wines and thoroughbreds: towards regional sustainability in the Upper Hunter, Australia. *Regional Studies* 42(9):1275–1290.
- Mickwitz, P. & Melanen, M. 2009. The role of co-operation between academia and policymakers for the development and use of sustainability indicators: a case from the Finnish Kymenlaakso Region. *Journal of Cleaner Production* 17(12):1086–1100.
- National Marine Protected Areas Center. 2004. *Stakeholder Participation: A Synthesis of Current Literature*. Silver Spring, MD: National Marine Protected Areas Center.
- Parris, T. & Kates, R. 2003. Characterizing and measuring sustainable development. *Annual Review of Environment and Resources* 28:559–586.
- Pirk, S. 2002. Expanding public participation in environmental justice: methods, legislation, litigation and beyond. *Journal of Environmental Law and Litigation* 17(1):207–240.
- Provincie Limburg. 2005a. *Limburgmonitor*. Maastricht: Provincie Limburg.
- Provincie Limburg. 2005b. *Versnellingsagenda 2005: Limburg op weg naar 2012*. Maastricht: Provincie Limburg.
- Provincie Limburg. 2005c. *Duurzaamheid Duurt Het Langst: Programma Duurzaam Limburg 2005–2007*. Maastricht: Provincie Limburg.
- Provincie Limburg. 2006. *Trendrapport: Inspiratie voor de Bestuursperiode 2007–2011*. Maastricht: Provincie Limburg.
- Provincie Limburg. 2007a. *Investeren en Verbinden: Coalitieakkoord 2007–2011*. Maastricht: Provincie Limburg.
- Provincie Limburg. 2007b. *Limburgmonitor*. Maastricht: Provincie Limburg.
- Provincie Limburg. 2007c. *Evaluatie Coalitieakkoord 2003–2007*. Maastricht: Provincie Limburg.
- Provincie Limburg (België). 2006. *Duurzaamheidsbarometer Limburg*. Hasselt: Provincie Limburg.
- Putzhuber, F. & Hasenauer, H. 2010. Deriving sustainability measures using statistical data: a case study from the Eisenwurzen, Austria. *Ecological Indicators* 10(1):32–38.
- Ramos, T. 2009. Development of regional sustainability indicators and the role of academia in this process: the Portuguese practice. *Journal of Cleaner Production* 17(12):1101–1115.
- Ramos, T. & Caeiro, S. 2009. Meta-performance evaluation of sustainability indicators. *Ecological Indicators* 10(2):157–166.
- Reed, M., Fraser, E., & Dougill, A. 2006. An adaptive learning process for developing and applying sustainability indicators with local communities. *Ecological Economics* 59(4):406–418.
- Regeer, B., Hoes, A., van Amstel-van Saane, M., Caron-Flinterman, F., & Bunders, J. 2009. Six guiding principles for evaluating mode-2 strategies for sustainable development. *American Journal of Evaluation* 30(4):515–537.
- Reitan, P. 2005. Sustainability science: and what's needed beyond science. *Sustainability: Science, Practice and Policy* 1(1):77–80. <http://ejournal.nbio.org/archives/vol1iss1/communityessay.reitan.html>.
- Robinson, J. 2004. Squaring the circle? Some thoughts on the idea of sustainable development. *Ecological Economics* 48(4):369–384.
- Sneddon, C., Howarth, R., & Norgaard, R. 2006. Sustainable development in a post-Brundtland world. *Ecological Economics* 57(2):253–268.
- Spangenberg, J. 2002. Environmental space and the prism of sustainability: frameworks for indicators measuring sustainable development. *Ecological Indicators* 2(3):295–309.

- Steinbuka, I. & Wolff, P. 2007. *Indicators and Better Policy-Making: The Case of Sustainable Development*. Luxembourg: Eurostat. <http://epp.eurostat.ec.europa.eu/portal/page/portal/sdi/files/LISBON%20ISI%20AUG%202007%20REV2.PDF>.
- Stevenson, F. & Ball, J. 1998. Sustainability and materiality: the bioregional and cultural challenges to evaluation. *Local Environment* 3(2):191–209.
- United Nations. 2007. *Indicators of Sustainable Development: Guidelines and Methodologies*, 3rd ed. New York: United Nations. <http://www.un.org/esa/sustdev/natlinfo/indicators/guidelines.pdf>.
- van Zeijl-Rozema, A., Cörvers, R., Kemp, R., & Martens, P. 2008. Governance for sustainable development: a framework. *Sustainable Development* 16(6):410–421.
- Viglizzo, E., Pordomingo, A., Castro, M., & Lertora, F. 2003. Environmental assessment of agriculture at a regional scale in the pampas of Argentina. *Environmental Monitoring and Assessment* 87(2):169–195.
- Wallis, A. 2006. Sustainability indicators: is there consensus among stakeholders? *International Journal of Environment and Sustainable Development* 5(3):287–296.
- Wiek, A. & Binder, C. 2005. Solution spaces for decision-making: a sustainability assessment tool for city-regions. *Environmental Impact Assessment Review* 25(6):589–608.
- Zilahy, G. & Huisingh, D. 2009. The roles of academia in regional sustainability initiatives. *Journal of Cleaner Production* 17(12):1057–1066.
- Zilahy, G., Huisingh, D., Melanen, M., Phillips, V., & Sheffy, J. 2009. Roles of academia in regional sustainability initiatives: outreach for a more sustainable future. *Journal of Cleaner Production* 17(12):1053–1056.