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ARTICLE

## Sustainable development: how to manage something that is subjective and never can be achieved?

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This article examines the notion of sustainable development that has emerged as a new normative orientation of Western society. We argue that sustainable development is an inherently subjective concept and for this reason requires deliberative forms of governance and assessment. We outline the contours of sustainability science as a new form of science, complementing traditional science. Such science is to be used in service to reflexive modes of governance, for which we outline the general principles and offer a practical illustration, the transition-management model. The example shows that it is possible to work toward sustainable development as an elusive goal through provisional knowledge about our needs and systems to satisfy these needs. Heterogeneous local understandings and appreciations are not suppressed but drawn into the transition process in various ways such as participatory integrated assessment and social deliberation. The social interest in sustainable development is exploited without falling into the modernistic trap of rational decision making that disregards local cultures.

KEYWORDS: sustainable development, public policy, social conditions, decisions, rights of future generations

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### Introduction

The essence of sustainable development is to provide for the fundamental needs of humankind in an equitable way without doing violence to the natural systems of life on earth. This idea was framed as “sustainable development” in the early 1980s and came from a scientific look at the relationship between nature and society. Sustainable development is also a stated aspiration of governments and societies. The notion represents a concern for the future in terms of well being and opportunities for development. Sustainable development is a kind of motherhood concept “encompassing three of the great goals of humanity, namely entitlement to health, wealth and justice in a single concept” (O’Riordan, 1996).

This article examines how problems of normativity, ambiguity, and uncertainty may be dealt with through sustainability science and reflexive modes of governance such as transition management. We will see that these problems cannot be handled in a once-and-for-all manner. One has to live with them and work with them. For this task sustainability science is useful, but it is certainly not a panacea. Sustainability science needs to be a part of reflexive modes of governance. In the Dutch transition management approach, which was to use sustainability science, this was only partially done. The article does not offer

conclusive evidence of the value of sustainability science. What it does is to point to the advantages of sustainability science for dealing with sustainable development issues.

### Sustainable Development as a New Orientation for Politics and Society

The idea of sustainable development or sustainability represents an attempt to link environment with development. This was effectively done through the report *Our Common Future* by the World Commission on Environment and Development (the Brundtland Report), which stated that critical global environmental problems resulted from both the South’s enormous poverty and the North’s unsustainable consumption and production. It called for a strategy that united development and the environment, described by the now-common term “sustainable development,” defined as “development that meets the needs of current generations without compromising the ability of future generation to meet their own needs” (WCED, 1987).

The Brundtland report argued that the vast and complex issue of environmental deterioration should be integrated with the equally vast and complex issue of human development and poverty, clearly suggesting that both challenges needed to be resolved si-

multaneously and in a mutually reinforcing way (Robinson, 2004).

The report was radical in stating that ecological sustainability cannot be achieved if the problem of poverty is not successfully addressed globally, but was reformist in its emphasis on growth. Sustainable development came to be formulated as a *different kind* of growth, one that is not harmful to the environment, bringing worldwide wealth and health. In this meaning, sustainable development is about conservation rather than preservation.<sup>1</sup> Sustainable development is progrowth and this is why people favoring value change and lifestyle change prefer the term “sustainability.” However, preservation elements remain in the precautionary principle.<sup>2</sup>

### Operationalizing Sustainability

Following publication of the Brundtland Report, numerous attempts were made to operationalize sustainable development. The most popular and common attempt is the triangular concept with the three pillars “economy,” “environment,” and “society,” which in recent years has in some contexts come to be referred to as the P3 concept of “people, planet, profits.”<sup>3</sup>

“Economy” refers to jobs and wealth; “environment” to environmental qualities, biodiversity, and nature’s resources; and “society” to health, social cohesion, and opportunities for self-development attributable to education and freedom.

The pillar-focused approaches have gained great popularity, particularly in business circles, but they have often suffered from insufficient attention to overlaps and interdependencies and a tendency to facilitate continued separation of societal, economic, and ecological analyses (Kemp et al. 2005). Alternative depictions stressing interconnections and consideration of institutional aspects—as in the PRISM model of Spangenberg et al. (2002), Farrell et al.

(2005) and the SCENE model of Grosskurth & Rotmans (2005)—offer useful ways forward.

Concerns with the poor and the weak that should be part of the sustainability debate do not feature prominently in the pillar approaches. These are, however, captured by the four principles of Newman & Kenworthy (1993):

- The elimination of poverty, especially in the Third World, is necessary not just on human grounds but as an environmental issue.
- The First World must reduce its consumption of resources and production of wastes.
- Global cooperation on environmental issues is no longer a soft option.
- Change towards sustainability can occur only with community-based approaches that take local cultures seriously.

An interesting aspect of the above definition is the attention given to local cultures and community-based decision making, a strategy that renders sustainable development less technocratic. In the beginning, ecocentered approaches dominated the sustainability discussion, but they have been increasingly criticized for being elitist and insufficiently democratic. Roe (1998) offers a penetrating criticism that condemns “resource management” approaches to sustainable development as “a new class version of managerialism that functionally serves to globalize and perpetuate the techno-managerial elite’s control over everyday life” and in so doing is antisocial. This is a strong statement, but indeed sustainable development is not an autocratic project whose content can be objectively determined. What sustainable development means is essentially a political decision (Hajer, 1995).

Democracy and civility have come to be increasingly subsumed under sustainable development. Such an approach is consistent with the seven principles advanced by Robert Gibson (2001) which also include integration, human-ecological system integrity, sufficiency and opportunity, equity, efficiency, and throughput reduction and precaution (Box 1).

The requirements of sustainable development are multiple and interconnected. The main dimensions can be said to consist of maintaining the integrity of biophysical systems; offering better services for more people; and providing freedom from hunger, nuisance, and deprivation. To these one may add choice, opportunity, and access to decision making—aspects of equity within and across generations (Kemp et al. 2005).

<sup>1</sup> Conservation should not be understood as being antidevelopment. As Gunderson & Holling (2002) observe, “conserving the elements and functions of our socioecological systems (even particular eco-systems or even species) cannot be the overall goal of sustainable development. Otherwise our objectives would be a-historic and would ignore the nature of evolutionary change and related variability. Rather, a conservation goal must be resilience—that is the ability to maintain and conserve the ability to adapt to changing conditions and to be able to respond flexibly to surprises, thus turning them into opportunities” (quoted in Farrell et al. 2005).

<sup>2</sup> In the following discussion the concepts of sustainable development and sustainability are used as synonyms, but readers should bear in mind that sustainability is more about preservation and less about progress.

<sup>3</sup> At the United Nations summit in Johannesburg in 2005, the P3 concept of “people, planet, profits” was changed into “people, planet, and prosperity.”

**Box 1** Principles of Sustainability

**Human-ecological systems integrity:** Build human-ecological relations to maintain the integrity of biophysical systems in order to maintain the irreplaceable life support functions upon which human well-being depends.

**Sufficiency and opportunity:** Ensure that everyone has enough for a decent life and that everyone has opportunities to seek improvements in ways that do not compromise future generations' possibilities for sufficiency and opportunity.

**Equity:** Ensure that sufficiency and effective choices for all are pursued in ways that reduce dangerous gaps in sufficiency and opportunity (and health, security, social recognition, political influence, etc.) between the rich and the poor.

**Efficiency and throughput reduction:** Provide a larger base for ensuring sustainable livelihoods for all through reducing threats to the long term integrity of socio-economic systems by avoiding waste and reducing overall material and energy use per unit of benefit.

**Democracy and civility:** Build our capacity to apply sustainability principles through a better informed and better integrated package of administrative, market, customary and personal decision-making practices.

**Precaution:** Respect uncertainty, avoid even poorly understood risks of serious or irreversible damage to the foundations for sustainability, design for surprise and manage for adaptation.

**Immediate and long-term integration:** Apply all principles of sustainability at once, seeking mutually supportive benefits.

Adapted from Gibson (2001).

**Interpretative Flexibility**

The previous sections elaborated on selective views regarding sustainable development, although the number of definitions is estimated to run into the hundreds. The plethora of definitions has been deplored for creating confusion, but it also has advantages. As Robinson (2004) writes, "any attempt to define the concept precisely, even if it were possible, would have the effect of excluding those whose views were not expressed in that definition." Open definitions help communities and groups of actors to identify sustainability programs and actions that befit their concerns. Without such flexibility, no action may come from such connections; rather only actions that meet official sustainability aspects, such as global warming, would be deemed appropriate. Variation in the sustainability concept allows for a multitude of actors, possibly the whole of society, to be involved, encouraging locally adapted solutions. National governments and multinational corporations are better placed to deal with global environmental problems, working conditions, and global poverty than local agencies which are presumably more suited to deal with local poverty and resources. We are not opposed to official sustainability concerns and targets, laid down in sustainability strategies at the national or local level, but an overly narrow range of goals can act as a straightjacket. Sustainable development is not about making progress in terms of three or four parameters, but about achieving a positive process of social change that avoids generating internal contradictions that might undermine further advances (Meadowcroft, 1999a).

Sustainable development is a contested concept even when the fundamentals are clear: maintaining the integrity of biophysical systems and reducing poverty and risks. From a governance perspective,

such disagreement is an essential part of sustainable development, but one that makes operationalization difficult:

- Different ideas exist regarding sustainable development for actors in various sectors (e.g., energy, transportation, agriculture, food systems, waste management).
- Existing solutions tend to be sustainable within these sectors rather than across the whole of society.
- New developments bring new risks that cannot be anticipated.
- Sustainable development is a long-term, open-ended project that precedes and supersedes limited term, democratically elected governments.
- Sustainable development involves making choices, and perhaps trade-off decisions, on highly contested issues (which is to say that in some cases the notion of a "trade-off" might prove to be no more than a euphemism for fundamental irresolvable dilemmas) (Farrell et al. 2005).

Sustainable development derives from social consensus on what we consider to be unsustainable and what constitutes progress, perspectives that will differ across nations and localities. The substantial content of sustainable development cannot be scientifically determined as "objective knowledge," but will always incorporate normative valuations that only become ascertained in the process of social interaction (Voss & Kemp, 2006). This situation calls for a different type of science, one able to deal with ambiguity, complexity, and uncertainty (Brand & Karvonen, 2007).

## Sustainability Science

Sustainability based on social consensus of what is unsustainable requires a special form of science. A new research paradigm is needed that reflects sustainable development's complexity and multidimensional character. The new paradigm must encompass different magnitudes of scales (of time, space, and function), multiple balances (dynamics), multiple actors (interests), and multiple failures (systemic faults) (Martens, 2006).

This new type of science should be able to deal with complexity, uncertainty, and legitimate multiple viewpoints. Such a challenge calls for mutual learning, integrated assessment, and conflict resolution. In terms of science, it demands what Gibbons et al. (1994) refer to as mode-2 science that is interdisciplinary and transdisciplinary and promotes a context in which knowledge is coproduced and provisional. This form of practice differs from normal academic science which is monodisciplinary and based on peer review by the scientists themselves. Mode-1 science will remain important, but it is unable to deal with issues of values and multiple viewpoints. In mode-2 science, the scientists interact with practitioners, policymakers, and citizens to produce knowledge for action (Table 1). No single set of knowledge or viewpoint is privileged (Wiek et al. 2005).

**Table 1** Properties of mode-1 and mode-2 science

Mode-1 science	Mode-2 science
Academic	Academic and social
Monodisciplinary	Trans- and interdisciplinary
Technocratic	Participative
Certain	Uncertain
Predictive	Exploratory

Adapted from Martens (2006).

A new field of sustainability science is emerging that seeks to understand the fundamental character of interactions between nature and society—at different scales—with special attention to the complex evolution of the nature-society system in response to multiple and interacting stresses (Kates et al. 2001). Sustainability science is not clearly defined, but central elements have begun to gain clarification (Martens, 2006):

- Inter- and intradisciplinary research.
- Coproduction of knowledge.
- A systems perspective with attention to the co-evolution of complex systems and their environments.
- Learning-by-doing (and learning-by-using) as an important basis of acquiring experience, besides

learning-by-learning (learning through detached analysis).

- Attention to system innovation and transitions.

Because sustainable development is an issue of complex systems and integration, systems science has a special role to play. Systems thinking is a way of understanding reality that emphasizes the relationships among a system's parts rather than the parts themselves (Hjorth & Bagheri, 2006). Systems thinking helps actors to see various systems aspects, to cross boundaries of science, and to create new conceptual frames that highlight interactions. It offers a powerful perspective, a specialized language, and a set of tools to address the most stubborn problems in everyday life and work (Hjorth & Bagheri, 2006). Models of complex adaptive systems are especially useful for conceptualizing change and developing steering strategies, as sustainability policy should combine the capacity to adapt to change with a capacity to *shape change* (Rammel et al. 2004). Soft systems methodology (Checkland & Scholes, 1990) offers a useful way to structure problems and to carry out integrated assessments. Dynamic issues of system change, such as path dependence, bifurcation, emergence, self-organization, and co-evolution may be analyzed with the help of complexity theory and agent-based models or evolutionary models (Gunderson & Holling, 2002; Windrum & Birchenhall, 2005).

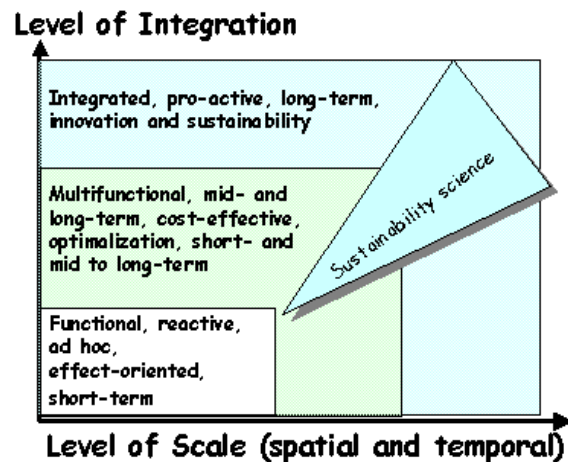
Sustainability science is an integrative science, a science that sets out to break down the barriers that divide the traditional sciences (Martens, 2006). It involves not just the integration of disciplines, but also different individual viewpoints and knowledges in processes of deliberation and assessment. Debate regarding sustainability projects should be inclusive and participatory. The development of mutual trust and understanding of the reasons for participation provides great potential for successful interactions between “expertise” and “democratic processes” (Cough et al. 2003). However, given the weakness of certain actors, care is needed to defuse pressures from the most active and vocal, thus offering the less articulate and less empowered an opportunity for reflection and decision making regarding sustainability action. Participatory strategies must balance the right of citizen choice with technical competence to ensure informed decisions. Effectively implementing such an approach will ensure that processes of change, shaped by sustainability principles chosen by the participants, will remain responsive to different and evolving needs (Wijayaratna, 2000).

One might say that sustainability is about locally suited options that are globally sustainable, but it is also about contextual awareness and behavior. Con-

flicts are likely to occur between localism and globalism, characterized by different mindsets and different logics for action, as noted by Rosenau (2003). The tensions are difficult to reconcile, as the controversy over globalization shows.

### Knowledge Implications for Policy

A look at the policy consequences of this new sustainability vision reveals the following. It is important for decision makers—both in politics and in the business community—that specific policy objectives, along with their associated time limits, be clearly determined. Figure 1 shows several possibilities. One of the options available to policymakers—and this is not so far from the current situation—is to aim for short-term goals and for simple or cheap means of achieving them. In contrast, a more proactive, innovative approach would pursue longer-term goals, taking into account developments at different levels of scale and in different sectors. Unquestionably, sustainable development demands the latter strategy.



**Figure 1** The role of sustainability science in the policy process (Martens, 2006).

To facilitate decision making, sustainability scientists must assist in rendering concrete both problems and solutions on all relevant temporal and spatial scales. This means that sustainability at the systemic level must be assessed, bringing to bear the following procedural elements: *analysis* of deeper-lying structures of the system, *projection into the future*, and *assessment* of sustainable and unsustainable trends. *Evaluation* of the effects of sustainable policy and the *design* of possible solutions through sustainable strategies are also necessary.

This sounds like a tall order. Fortunately, integrated approaches to sustainability issues in such

areas as environment and development are not entirely new. The search for integrated theories that combine different disciplinary strengths is one way of creating a better decision-making basis regarding sustainability issues.

There is already evidence that an emergent form of sustainability science can help to deal constructively with the ambiguity, complexity, and uncertainty central to sustainable development. This challenge is taken up through an explicit concern with the wants and needs expressed by society and their system-wide effects across various scales. It does not aim at precision, but at exploration.

### The Role of Visions

Should sustainability policy be based on visions? In general, sustainability researchers assign a positive role to visions. Visions challenge the dominant perspective of past and present and can inform action for innovative change, for instance the creation of a hydrogen economy. Visions may also help to make explicit what is involved in wide-ranging change, which can be useful for thinking and assessment and, of course, for action. Smith et al. (2005) identify five functions of visions.

1. *Mapping a possibility space*: Visions can help to identify the realm of plausible alternatives for conceiving sociotechnical functions and for the means of providing for them.
2. *A heuristic*: Visions can guide problem-solving activities.
3. *A stable frame for target-setting and monitoring progress*: Visions can stabilize technical and other innovative activity by offering a common reference point for actors collaborating on their realization.
4. *A metaphor for building actor-networks*: Visions can specify relevant actors (including and excluding) and can act as symbols that bind together communities of interest and practice.
5. *A narrative for focusing capital and other resources*: Visions can become emblems employed in the marshalling of resources from outside an incipient regime's core membership.

Visions can help to guide thinking and inform processes of action for achieving certain outcomes—material outcomes—but even more crucially learning outcomes that can inform further action. Through visions, new paths of development may be explored. While these are, of course, positive aspects of visions, they also have negative aspects. First, visions can advance the objectives of special interest groups that may not be consistent with the needs of wider

groups, communities, and nations. Second, change may be ambiguous or even harmful. Serious repercussions and social costs may outweigh any benefits. These observations suggest that visions should be continuously assessed and refined and they should reflect the wider community interests and not just those of select groups.

Visions are important, perhaps even necessary, for system change. But any fundamental change also produces undesirable side effects and new risks. From a sustainability point of view, it is important to be mindful of these adverse implications and to contain them as early as possible in the overall process. Nuclear energy stands out as a prime example, but this point also holds for renewable forms of energy. For instance, the large-scale production of energy crops may destroy valuable ecosystems and the social fabric of local communities.

Because of this potential for unintended consequences, it is better to *explore multiple visions* and not just one. Visions create better worlds *together* rather than apart. Sustainable development requires *diversity* in technology, institutions, and ways of thinking. Diversity should be tolerated, even stimulated, as it offers a resource base for adaptation and reorganization (e.g., Lister & Kay, 2000; Rammel & van den Bergh, 2003). Diversity in product offerings is also needed for meeting heterogeneous preferences and to cater to local circumstances (Kemp et al. 2005).

The above three needs—integrated assessment that takes into account multiple viewpoints and concerns, interpretative flexibility, and learning and guidance—mean that decision making and policy for sustainable development should be reflexive, that the actors themselves should become aware of basic assumptions and mechanisms that help them to deal in novel ways with newly perceived problems.<sup>4</sup> Sustainable development requires increased capacity for reflection and an adaptive framework for making instrument choices.

### Sustainable Development Requires Reflexivity

Many modernist policies have led to undesirable outcomes. Examples abound. Rational town planning has created inhospitable places for humans to live and interact. Scientific forestry practices have resulted in reduced timber production because of increased vulnerability to disease and weather (Scott, 1998). To avoid regrettable and disappointing results, sustainable development policy should have an in-

built capacity for assessment and adaptation. What is needed are *reflexive* modes of steering and governance geared toward continued learning in the course of modulating ongoing developments rather than the maximization of control to achieve certain outcomes (Voss & Kemp, 2006). For this kind of learning to occur we need *reflexivity* on the part of the actors (about system effects and their own needs) and mechanisms of feedback on promising solutions, instruments, and forms of governance.

Practical instances of reflexive governance can be found in approaches such as constructive technology assessment (Rip et al. 1995; Schot & Rip, 1997), foresight exercises (Grin & Grunwald, 2000), transdisciplinary research (Wiek et al. 2005), and participatory decision making and cooperative policy making (Meadowcroft, 1999b). Similar evidence can be found in more comprehensive approaches for steering policy decision making such as transition management and adaptive management. Reflexive techniques facilitate several kinds of learning processes and help to modify our decision rules and mental models of the real world as we go along (Hjorth & Bagheri, 2006).

Sustainable development requires learning that feeds into decision making. Learning is needed on many fronts. We need learning about how to make products more ecofriendly, but also about new socio-technical systems for the delivery of goods and services. Learning is also needed regarding new business models based on sustainability and about how existing systems of governance can be made more reflexive. We furthermore need to learn about our “real” needs (instead of assumed needs) and various ways for meeting those needs in more sustainable ways.<sup>5</sup>

One approach that encourages reflexive governance is transition management (described in Rotmans et al. 2001; Kemp & Loorbach, 2006; Kemp et al. 2006; Loorbach, 2007), which consists of the following elements:

- The development of sustainability visions and the setting of transition goals.
- The use of transition agendas.
- The establishment, organization, and development of transition arenas (for innovative actors) besides the normal policy arena.
- The use of transition experiments and programs for system innovation.

<sup>4</sup> Interestingly, the notion of sustainable development is an example of reflexivity in which environmental protection was linked to poverty and development, creating a new normative viewpoint.

<sup>5</sup> According to Reisch (2001) understandings of welfare and “real” needs have become distorted (quoted in Shove, 2005). This is a controversial view, but human needs do evolve—endogenously and exogenously in transition processes.

- The monitoring and evaluation of the transition process.
- The creation and maintenance of public support.
- The practice of portfolio management.
- The use of learning goals for policy and reliance on circles of learning and adaptation.

Transition management offers a set of strategies for working toward sociotechnical “regime changes”—alternative systems of production and consumption that can help to reduce environmental impacts while yielding attractive services for users. Emergent alternatives should ideally combine individual and social benefits. This objective cannot be achieved on a short time basis and instead requires innovation at many points and levels, including governance. Policy actions are evaluated against two types of criteria: 1) the immediate contribution to policy goals (for example in terms of kilotons of carbon-dioxide (CO<sub>2</sub>) reduction and reduced vulnerability through climate change adaptation measures); and 2) the contribution of the policies to the overall transition process. This two-pronged means of evaluation suggests that under transition-management policies have both a *content goal* and a *process goal*. Learning and institutional change are important policy aims and policy goals are used as means for change. The evaluation and adaptation of policies, strategies, and institutional arrangements in “development rounds” brings flexibility to the process without losing a long-term focus (Rotmans et al. 2001).

Transition management is not an instrumental activity. It accepts that actual policies are the outcome of political negotiations and processes involving the coevolution of governance and sociotechnical change that in turn inform further steps.<sup>6</sup> Transition management can create a new context for such processes, one in which sustainable solutions and structures can emerge due to participatory processes that develop, monitor, and evaluate new visions, institutions and coalitions, and experiments (Loorbach, 2007).

### Transition Management in the Netherlands

Transition management is currently being used in the Netherlands as a model for sustainable development. Various ministries are adopting this approach following an initial period of learning and exploration. The Ministry of Economic Affairs (responsible for industry, innovation, and energy), for

<sup>6</sup> The term “coevolution” refers to evolutionary processes that are part of more than one selection environment (van den Bergh & Stagl, 2003).

instance, has accepted transition management. Officials in the Ministry have been very active since 2001 in developing transition policies for a national sustainable energy supply system by 2050 and have opted for a co-management approach (Meadowcroft, 1999b).<sup>7</sup> In 2001, the Ministry started consulting various stakeholders (e.g., companies, researchers, nongovernmental organizations) to assess whether they saw possibilities for a transition and, if so, what these chances might be. Based on these conversations and an intensive scenario study (*Lange Termijn Verkenning Energie* (Long-Term Vision Energy) released in 2001), “robust elements” were selected for dealing with uncertainty. One element identified was the gas grid which could be used to distribute hydrogen and biomass-based gas. This process led to the identification of biomass and new gas (involving specific solutions such as micro-cogeneration and hydrogen) as interesting options.

In 2002, the Ministry started Project Implementation Transition (PIT) to investigate whether an array of sub-projects would generate sufficient support, enthusiasm, and commitment from the relevant stakeholders to create a climate in which they would be willing and able to work together. The project was initially financed with 35 million Euros (US\$47 million) and supported by an eight-person staff. The main conclusions from this phase were that the transition approach appealed to a majority of stakeholders and they would be willing to invest time and money if the process were more concrete, more explicit visions for the future could be developed, and the government would support the transition both financially and procedurally.

Based on these findings, a green light was given for implementation of Phase 2 in 2003. The objectives of this stage were to develop a long-term vision on energy in general; to get all relevant actors in each of the subprojects to commit to the process; to map possible paths, barriers, and necessary preconditions for the transition; to set up plans for knowledge development, sharing, and communication; to chart international developments; and to develop transition experiments. In the case of biomass, the following vision emerged (Figure 2).

This particular figure, developed by actors of the biomass platform, is illustrative of the transition-management approach. There is a vision in which biomass plays an important role in the primary energy supply systems, with medium- and long-term goals and certain transition paths. The goals are indicative ambitions for the actors concerned. The paths evolve with time, benefiting from all kinds of learning processes, both technical and social. Similar

<sup>7</sup> For further details, refer to <http://www.energietransitie.nl>.

visions are being developed for other energy supply options with different visions coexisting alongside each other.

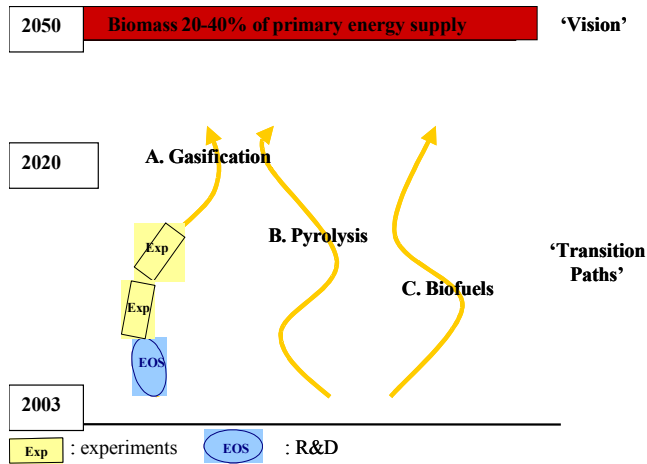


Figure 2 The Dutch vision for biomass

At the heart of the Dutch transition approach are so-called transition platforms consisting of people from business, academia, government, and civil society. In the energy transition, six platforms have been created: green resources, new gas, chain efficiency, sustainable mobility, sustainable electricity, and built environment. The platforms have played a pivotal role in the selection of main routes, the identification of possible transition paths, the identification of transition experiments, and the development of a broader transition community. The platforms' proposals for transition paths were brought together in a transition-action plan presented to the Dutch government and public in May, 2006.<sup>8</sup> The plan contained 26 paths (which later developed into 28 paths) for further exploration (not implementation). The transition-action plan furthermore argued for the doubling of energy-innovation expenditures [from 1 to 2 billion Euros a year (US\$1.4 to 2.7 billion), to be allocated from general revenue] and made a plea for "consistency and continuity of policy based on a long-term vision about sustainable energy."

The policies in the transition-action plan made little use of sustainability science. The paths were identified by a selected group comprised mainly of business people and energy experts. The public was not involved in the process. Up until now, demand-side issues, wider considerations of societal embedding, and system-wide effects have been neglected. The transition experiments are very technological by

<sup>8</sup> The transition-action plan was developed by the taskforce on energy transition. The chairpersons of the platforms were members of the taskforce.

nature; they are hardly aimed at fostering institutional or cultural changes. Efforts thus far have consisted of rather low-risk projects primarily related to CO<sub>2</sub> reduction (and not, for instance, to security). Participants in the process have neglected strategic issues related to integrated system analysis. An old scenario study for the energy system was used. Participatory scenario development [as advocated for transition management by Sondejker et al. (2006)] was not part of the process. Sustainability assessment did not play an important role in the formulation of the various paths. Only biofuels were selected for inclusion in a large study that was commissioned to determine criteria for "sustainable biofuels."

Further analysis is required to determine why sustainability science was not used more extensively, though the relatively closed composition of the platforms seems to have been important in this regard. The platforms explored the future and engaged in problem structuring, but that was all. They neither developed long-term scenarios nor engaged in participatory integrated assessment of the paths that were selected. Perhaps the government has a specific role in sponsoring these activities.

This experience suggests that the deployment of sustainability science requires strong political commitment. Otherwise, neither the traditional scientific community nor businesses will use sustainability science processes. This observation cautions against great optimism. With increasing attention to issues of societal embedding and culture in the energy transition this situation may change, but it probably will remain problematic.

## Conclusion

This article has discussed sustainable development and the twin notion of sustainability. From an anthropocentric point of view, sustainable development is about human betterment or progress. It reflects social consensus about what is unsustainable and what constitutes improvement, and therefore cannot be translated into a blueprint or a defined end state outlining specific criteria and calling for unambiguous decisions (Voss & Kemp, 2006).

Sustainable development is often seen as being about protection of amenities (including cultural diversity), but, as this article argues, it is equally about continued advancement and creation: a better and more just world. Both the protection of amenities and the creation of new and better services for more people require innovation in governance institutions and in sociotechnical systems (regime changes). Attempts to achieve these objectives should be carried out in a prudent, reflexive manner to avoid new problems and to make sure that actions taken lead to progress.



Sustainability science, based on integrated assessment, may help to identify directions in which change is needed. But the sustainability of new trajectories is not guaranteed. We need more reflexive modes of governance to ensure that the trajectories are indeed sustainable. Here the approach of transition management may prove useful. Transition management aspires to be inclusive and calls for setting medium- and long-term goals, for aligning short- and long-term policies, and for conducting strategic experimentation to supplement the use of traditional policies (e.g., regulation, taxes). It aims to achieve systemic change through small steps in strategically chosen directions. The “management” that is involved works through self-organization and uses visions and feedback cycles to convey the lessons of new experiences and endogenous institutionalization. It tries to avoid the modernist trap of rational decision making without, at the same time, being antidevelopment. Transition management helps to work towards a sustainability transition even when no one knows what a sustainable society would actually look like and the very idea of achieving sustainability may be illusory (O’Riordan, 1996). It is not a way to manage cultural change, but rather an approach for fostering innovation, especially system innovation. In the Netherlands the method is used, but only in a partial way. Greater involvement of society in the transition- management process is needed and more attention should be given to issues of societal embedding.

Sustainability science can guide decision making, providing provisional knowledge about social problems, the desirability of new systems of provision, and the long-term effects of interventions—issues for which customary science has no definitive answer. We do not think that sustainable development can be operationalized using mode-1 science. To try to do so would go against the grain of sustainable development as a deeply normative process that requires attention to long-term effects across various scales (e.g., geographic, functional systems, time). Sustainability may be understood as a specific kind of problem framing that emphasizes the interconnectedness of different issues and scales, as well as the long-term and indirect effects of actions that need to be accounted for as part of decision making (Voss & Kemp, 2006).

The overall conclusion with regard to this article’s central problem is that sustainable development cannot be managed like a company, but it is nonetheless possible to work toward successful management via reflexive forms of governance that use sustainability science. We realize that this conclusion needs solid evidence beyond what this article is able to provide.

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