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Sustainable Development of Rural Areas — Methodological Issues

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Abstract:

In this paper, we present sustainable development as key principle for rural policy, and propose a combination of methodologically different approaches for rural policy analysis and the support of rural development processes. *Formal analysis*, using optimisation and simulation procedures, is necessary for the assessment of consistent terms of sustainability that constitute the boundaries of the regional opportunity space for sustainable development. This calls for an adequate representation of the dynamic system in an integrated assessment framework to take into account efficiency and equity requirements as well as local value judgements and local knowledge. Results shall serve as guidelines for local actors to effectively manage change toward sustainable development. *Action-oriented participatory approaches* will be necessary to integrate local stakeholders in a social discourse, and to facilitate the process of regional capacity building and innovation, which is required to effectively manage change toward sustainable development. Stakeholders' participation in the entire process may help to improve the acceptance of scientific results, and to agree upon policy targets that are based on these results. Moreover, participatory approaches allow to collect information about cultural values, social capital, local knowledge and system understanding, and to assess the social welfare function. This information can then be integrated in the formal analysis, and help to assess consistent terms of sustainability.

1. Introduction

Sustainable development is a multidimensional principle which implies a far-reaching challenge to manage change. It is a normative principle which calls for integrating social, ecological and economic objectives at various geographical scales, and ensuring compliance with general system requirements, such as ecological and cultural integrity, economic stability, social equity, and economic efficiency. In general terms, sustainable development requires that some suitably defined aggregate of social, ecological and economic capital must be maintained intact over time. Moreover, critical components need adequate consideration. For human activity, this implies limitations imposed by social, ecological, economic and institutional capacities. Apart from global environmental constraints, these limitations are mainly defined at the local scale. Therefore, it will be adequate to primarily define terms of sustainability at a local, rather than global scale. These terms shall serve as guidelines for regional development as well as sectoral policies.

A recent OECD report on agricultural policy and rural economies (OECD, 1998) shows that the socio-economic development of rural areas, and the management of rural landscape have become important issues for agricultural policy design in many OECD countries. A key conclusion of the report is that traditional agricultural support policies are increasingly ineffective in accomplishing rural development objectives, and that agricultural policy reform can enhance the contribution of the agro-food sector to a viable development of rural economies, in the long-run. However, the benefits of such policy reform are not instantaneous, and the impacts could be greater in the downstream and upstream sectors than within agriculture itself. Moreover, such policy reform involves adjustment processes, and thus costs in the short term, while most benefits are not directly perceived by decision-makers. The latter are often more interested in realising immediate improvements of the agro-food industry and regional economy in terms of competitiveness and employment. These short-term objectives can be in conflict with the long-term objective of maintaining the overall capital base of the region, since short-term orientation of development strategies can undermine the dynamic competitiveness and development potential of rural areas. This potential does not only depend on the economy's production capacity, but also on a variety of environmental conditions and the social competence of local actors.

Correspondingly, the key challenge for rural policy analysis is to find a balance between the various objectives of rural development. In particular, this calls for a balance between short-term goals of competitiveness and long-term goals of maintaining the regional stock of

capital. For this purpose, a comprehensive analysis is required to deal with the inter-linkages between the agro-food sector and the economic, societal and environmental systems of rural areas, and the national and international political and economic context.

The aim of this paper is to elaborate an integrated framework for regional sustainable development analysis which is based on an overall system perspective and can be communicated to local decision-makers. This shall support the design of rural policy instruments that are more effective than those actually in use, support local processes of innovation, and help to initiate change toward sustainable development of rural areas.

Since the choice of appropriate geographical units is essential for the outcome of such territorial analyses, we first present some definitions and characteristics of rural areas and rural development. In section three, we continue with considerations about the concept of sustainable development and alternative approaches to define operational terms of sustainability at the regional scale. This constitutes the basic framework of analysis. In section four, we extend this framework to address structural interdependencies and dynamics of regional systems in a formal analysis. Section five is dedicated to the role of local actors, and methods to facilitate their participation in the process of rural development. Finally, we propose a conceptual framework to combine formal-analytical approaches and action-oriented, participatory approaches.

2. Characteristics of rural areas and rural development

Rural areas can be defined with respect to different aspects of rurality; namely geographic, environmental, economic, social and cultural criteria. In general, they will be different for urban and rural regions (settlement dimension), for regions with different industrial structures and different composition of the total stock of capital, including environmental resources and cultural heritage (structural dimension). Since this can markedly change with the degree of development, our analysis shall be restricted to highly developed OECD countries, and exclude less developed countries for which rural characteristics and findings may be different.

First, the difference between rural and urban regions is the different degree of rurality and urbanisation, respectively. This *settlement dimension* is characterised by a different share of rural population living in rural and urban regions. For the purpose of rural-urban analyses in an international context, the OECD has defined *rural regions* (“predominantly rural regions”) as regions with a majority of people living in rural communities; this is, more than 50% of the region’s population living in communities with less than 150 inhabitants per square kilometre. By contrast, *urban regions* (“predominantly urbanised regions”) are regions with less than

15% of the regional population living in rural communities. *Intermediate regions* (“significantly rural regions”) are defined as regions that have population shares between 15% and 50% living in rural communities (OECD, 1995; Von Meyer and Muheim, 1996). From this perspective, rural areas comprise more than 90 percent of the national territory in OECD countries (OECD, 1998).

Yet, not only the settlement dimension, but also the sectoral composition of the regional economies and inherited assets are key factors for the future development of local economies (structural dimension). A main difference between rural and urban areas is that rural economies depend more directly on environmental resources than urban economies. Land and other natural resources are direct inputs into production processes in agriculture and forestry. Moreover, the quality of the environment, which is characterised by a landscape consisting of semi-natural and natural areas, is an asset for rural tourism, as well as for the attractiveness of a region for living and for leisure activities. Agriculture is no longer the backbone of rural economies. Nonetheless, their structure is still characterised by relatively high shares of agriculture and other resource-based industries that are declining. But, with respect to their development performance during the 1980s, rural economies in the OECD area are not outperformed by urban ones. “The emerging ‘winners’ were apparently intermediate regions, which are significantly rural in character but possess a network of easily accessible towns” (Von Meyer and Muheim, 1996).

The demographic structure is different in rural than in urban areas. It is characterised by a relatively high share of young and old-aged people with respect to the total population in rural regions. As a consequence, for most Western European countries, as well as for Canada and the United States, demographic pressures in the labour market are higher in rural than in urban regions (Von Meyer and Muheim, 1996). In addition, for the period 1980 to 1990, rural regions in Switzerland show a lower number of commuters, significantly lower income level, and, despite the highest reproduction rate, lower rate of net population growth, in comparison with intermediate regions (cf. Botschaft zur Neuorientierung der Regionalpolitik, 1996).

In short, the structural dimension of rural development can be described as follows:

“Rural areas differ markedly in their development experience, economic structure, natural and human endowments, geographical location, demographic and social conditions. Therefore, they are affected in different ways, and to differing extents, by socio-economic and policy changes shaping the national and economic environment” (OECD, 1998: 15).

Hence, there is a need for re-orientation of rural development policies, turning away from mere distributional motives and economic compensation goals. More emphasis should be put on economic efficiency through a better use of the development potential which is specific to each region (OECD, 1995). This requires to take advantage of current potentials and comparative advantages of each region in order to increase regional per-capita income and employment. However, measures can no longer be reduced to the provision of information, infrastructure, direct income support and public goods. Rather, a coherent, well co-ordinated and targeted policy is required that aims at improving the competitiveness of rural areas through diversification and promotion of high-quality regional products, while maintaining the overall capital base of each region intact over time. This is a multi-faceted task that, by nature, must be dealt with locally. At the same time, consideration must be given to the growing integration of rural areas in the national and international economy, while keeping in mind the overall social and environmental context of regional development.

From this perspective, the promotion of competitiveness should aim at maintaining and enhancing the welfare potential of rural economies in the long-run rather than being fixed on short-term goals. This calls for a dynamic view and the expansion of development potentials through adequate policies and regional initiatives, innovation and co-operation. These potentials depend upon existing economic, environmental and social capacities, and dynamic interdependencies among these assets. They need to be enhanced to achieve primary goals of regional development, namely continuous growth of per-capita income and achievement of a high quality of life, and to preserve the environment and cultural heritage in the long run. Making rural areas attractive places for living can be seen as a prerequisite for reaching this long-term objective.

3. Sustainable development as a regional policy concept

A key challenge for rural policy is to strike the right balance between the short-term goals of improving regional competitiveness and employment, and long-term concerns of social, economic and ecological integrity. Apparently, sustainable development is the key principle for integrating these issues, and evaluating the trade-offs among the different goals (cf. Barbier, 1987).

Sustainable development is generally defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987: 43). This is a normative concept which has evolved from different

development paradigms, encompasses economic, social and ecological perspectives, and contains within it key concepts of equity, needs, wants (aspirations) and limitations.

The main concept behind the idea of sustainable development is an ethical imperative of intergenerational and intragenerational *equity*, which has evolved from the development paradigm of equitable growth (Munasinghe, 1993). This requires that first priority should be given to meet the essential *needs* of the world's poor. But, to serve as a viable development concept, it also requires to satisfy human *wants* (aspirations) that go beyond the mere satisfaction of basic needs (WCED, 1987).

In addition, the concept of sustainable development implies *limitations* that need to be imposed on economic development. They are determined by institutional arrangements and technologies, and by current capacities of the environment to assimilate impacts and regenerate itself. The recognition of such limitations reflects a paradigm shift that occurred in the 1980s, where environmental protection has become a third major objective of development, beside efficiency and equity (Munasinghe, 1993). This does not imply preservation of every ecosystem everywhere. Rather, it requires that our natural life-support system must not be endangered, and that adverse impacts on the quality of the environment are minimised such as “to sustain the ecosystem’s overall integrity” (WCED, 1987: 46).

Concepts weak and strong sustainability

The conception of sustainable development is much broader than the scope of the traditional conservation-versus-development debate. Sustainable development requires that the goals of social and economic development should be defined in terms of sustainability. However, notional definitions of these terms are source of confusion, rather than contributions that could help to reinforce the root idea of sustainable development. As a consequence, there is disagreement about the conceptual and operational content of the terms, which has resulted in different paradigms of “weak” and “strong” sustainability (cf. Hediger, 1998b).

On the one hand, the concept of “weak” sustainability involves an economic value principle which is founded within the body of neoclassical capital theory. It requires that some suitably defined value of aggregate capital—including human-made capital and the initial endowment of natural resources and social assets—must be maintained intact over time (Pearce et al., 1994; Turner et al., 1994):

- In narrow terms, “*very weak sustainability*” requires that the generalised production capacity of an economy is maintained intact, such as to enable constant consumption per capita through time (Solow, 1974, 1986; Common and Perrings, 1992).
- In broader terms, “*weak sustainability*” requires that the welfare potential of the overall capital base remains intact (Pearce et al., 1994; Opschoor, 1996).

On the other hand, the idea of “strong” sustainability emerged from the pre-analytic vision of ecological economics, saying that the economy is an open subsystem of the finite and non-growing global ecosystem, the environment (Costanza et al., 1991; Daly, 1991a; 1991b). It involves a bio-physical principle which is founded upon the laws of thermodynamics, and requires that certain properties of the bio-physical environment must be sustained:

- As a minimum necessary condition, “*strong sustainability*” requires that the total stock of natural capital remains constant over time (Costanza et al., 1991; Costanza, 1991; Daly, 1991a; Pearce et al., 1994). However, from an ecosystem perspective, it seems more appropriate to formulate an ecological principle which only requires to maintain the overall quality of the environment (ecological capital) intact over time (Hediger, 1998a, 1998b).
- In their attempt to make sustainability an operational principle, Costanza (1991) and Daly (1991a, 1991c) proposed that every investment project should meet a set of minimum sustainability standards for natural resource use and waste discharge into the environment. This is a stationary-state principle, which is also referred to as “*very strong sustainability*”. It is static, and not generally consistent with ecological and economic system requirements, such as the above ecosystem principle of strong sustainability, or efficient use of scarce resources (Hediger, 1998a).
- Another approach to strong sustainability is based on the concepts of critical natural capital, carrying capacity, and resilience (cf. Common and Perrings, 1992; Pearce et al., 1994; Pearce et al., 1996; Toman, 1994; Turner et al., 1994; Hediger, 1998b). We refer to this as “limits, or thresholds of *criticality*”, that must be respected at any time.

Differences among these concepts are a result of different visions about what a sustainable world can and should look like. It implies different objectives of “what it is, that should be sustained”, and different conceptions of capital. Correspondingly, to make sustainable development an operational concept, we need to have a clear conception of economic, social and ecological capital. These are aggregate assets—stock and funds (cf. Gowdy and O’Hara,

1997)—that are generated through the productive capacities and support the functioning of economic, social and ecological systems.

The composition of total capital

From an overall perspective, total capital involves three types of capital that are strongly interrelated and need to be jointly considered as fundamental elements for the analysis of sustainability and development. They consist of partly overlapping aggregates of economic, ecological and social assets, that are defined at a local scale.

1) We refer to *economic capital* as an economy's generalised productive capacity. It consists of human-made capital—including physical assets (machines and buildings) and immaterial assets (such as knowledge and know-how, social organisation, institutions, and the state of technology)—as well as natural resources (including non-renewable resources, renewable resources, and land) that are appropriated for economic activities. The value of economic capital is measured by the aggregate *income*, which, in correspondence with Hicks (1939), is defined as the maximum amount of consumption that can be spent in one period without reducing real consumption opportunities in the future. In addition, *macroeconomic stability* is considered as an economic asset, which is important for the overall performance of an economy. It is measured with reference to economic stability goals, as full employment, zero inflation, and equalised balance of payment.

2) We refer to *ecological capital* as the total of renewable resources (both used and non-used in economic production), semi-natural and natural land areas, as well as ecological factors, such as nutrient cycles, climatic conditions, biodiversity, and the resilience of ecosystems. By contrast, *natural capital* is broader in conception. It is referred to as the natural resource base of a geographic area, which consists of non-renewable resource stocks, developed land, and the ecological capital of a regional ecosystem.

3) We refer to *social capital* as a society's capability to deal with social, economic and environmental problems and to be active in shaping the development of the overall system. This is an extension of Berkes' and Folke's (1994) definition of *cultural capital*. It consists of socio-cultural values and norms, learned preferences, human capital and labor force, local knowledge of the environment, social competence and institutions, human health and life expectancy, as well as cultural and social integrity, and social cohesion (see also Atkinson et al., 1997).

A formal definition of weak and strong sustainability

We can now define formal terms of weak and strong sustainability with reference to the above compartments of total capital. To this end, we define “social welfare” as a function of aggregate income Y , macroeconomic stability M , social capital S , and ecological capital Q :

$$U = U(Y, M, S, Q)$$

This “*socio-ecological economic value function*” allows to take into account that social well-being is not only determined by the level of income (consumption), but also by macroeconomic stability, socio-cultural heritage, and environmental quality. This is an extension of the above sustainability framework to the social and macroeconomic context of human development (Hediger, 1998c). It allows to evaluate trade-offs across the various system goals, and reformulate terms of weak and strong sustainability with respect to changes of economic, social and ecological capital.

Weak sustainability requires to keep the aggregate value U of the overall capital base at least constant over time, while strong sustainability can no longer be restricted to issues of maintaining some natural capital intact. Rather, strong sustainability is defined in terms of economic, social and ecological sustainability:

$$\text{weak sustainability:} \quad \dot{U} = U_Y \dot{Y} + U_M \dot{M} + U_S \dot{S} + U_Q \dot{Q} \geq 0$$

strong sustainability:

- *economic sustainability:* $U_Y \dot{Y} + U_M \dot{M} \geq 0$
- *social sustainability:* $\dot{S} \geq 0$
- *ecological sustainability:* $\dot{Q} \geq 0$

Minimum requirements for ecological and social sustainability are non-decreasing stocks of ecological and social capital, respectively. Economic sustainability requires that the aggregate value of income and macroeconomic performance will not decrease over time. This represents the traditional trade-off among macroeconomic stabilisation goals, namely adequate income growth, full employment, and price-level stability. By contrast, weak sustainability allows for trade-offs across the various system goals. It only requires that the aggregate value of economic, social and ecological capital will be maintained intact over time, whereas the aggregation weights (U_Y , U_M , U_S and U_Q) correspond to the marginal social value of aggregate income and the current state of the economic, social and ecological system, respectively.

As stated above, the different aggregates of capital are more usefully defined at a local than global scale. Income growth and full employment are the classical economic objectives of regional economies and regional policy. In addition, ecological and social capital are important local assets for economic and social development, especially in rural areas (cf. OECD, 1995, 1998). Therefore, sustainable development should be understood as a local principle of socio-economic progress within bounds that are compatible with global constraints, local environmental capacities, and cultural values and norms of local societies. As economic, social and ecological conditions vary in space and time, the above terms of sustainability should be assessed in the spatial and temporal context. Hence, the objectives of development must be clearly expressed and agreed at the local scale, and the relevant socio-economic and environmental processes must be clearly understood and properly managed.

In correspondence with the inherent logic of regional sustainable development analysis (Nijkamp et al., 1992), spatially differentiated approaches are required to take into account differences in structures, initial conditions, functional dynamics and vulnerability of systems across different regions. This requires methodologically different approaches. On the one hand, the use of simulation and optimisation models in formal analysis is adequate for the assessment of consistent terms of sustainability, that depend on the dynamics and functioning of the overall system. On the other hand, action-oriented, participatory approaches are adequate for integrating local actors in the process of development. This is of particular importance with reference to the inclusion of local knowledge and values, and the facilitation of local actors' contribution and acceptance.

4. Formal analysis

Sustainable development analysis involves an approach which allows to jointly address economic efficiency and social equity within and between generations, and to integrate these issues together with ecological, economic and social system requirements in a comprehensive framework. The latter is required for the assessment of a consistent set of sustainability terms that define the boundaries of the opportunity space for regional sustainable development, and for the evaluation of alternative development strategies. To answer this question of feasibility, we need “a theory that can situate economic activities and social actors within the natural world in a concrete and useful way” (Duchin, 1996: 286), and formal analysis to evaluate the trade-offs among alternative options of development.

Structural economics and system dynamics provide a useful conceptual framework for such analysis. It is based on a theoretical and methodological extension of Leontief's input-output

economics to the dynamic context of a socio-ecological economic system (Duchin, 1996). It involves a structural representation of interdependencies among various compartments of the economic, social and environmental system within a region, and interaction with other regions. Such interdependencies consist of flows of material and energy, as well as various kinds of services and transfers between different firms and industries, households and social actors, and the environment.

From an ecological-economic perspective, the analysis cannot be restricted to a conventional input-output model of the economic system and direct interactions with other systems. Rather, the structural analysis must be based on a comprehensive representation and sufficient understanding of functional relationships and internal dynamics within the entire regional system. The formal representation of this dynamic system results in a set of differential equations, that may also contain qualitative information. Such differential equations are essential to describe the intertemporal variation of economic, social and ecological capital, which is important for the definition of operational terms of weak and strong sustainability. Moreover, the formal representation of non-linear processes within the overall system is crucial for the assessment of boundaries of the opportunity space for sustainable development. These are the limits (thresholds) of criticality, beyond which any impact could result in irreversible change (Common and Perrings, 1992; Turner et al., 1994; Pearce et al., 1996). These limits are characterised by non-substitutability of some components of economic, social and ecological capital, respectively.

These thresholds are crucial for sustainable development. As minimum requirements of ecological and social integrity, and human needs, they restrict the social opportunity space for sustainable development, and must be respected at any time (cf. Hediger, 1998b). They are not fixed in space and time, and, in general, do not correspond to the stationary-state constraints of very strong sustainability. Rather, these critical limits depend on the overall economic, social and ecological system, that can vary in different locations and situations. Therefore, they must be continuously assessed through an adaptive process of trade-offs. Hence, the assessment of operational and consistent terms of sustainability needs to be based on a long-term and total system perspective. Apparently, simulation methods are the most useful to solve such problems, in particular if the real problem cannot not be sufficiently well described in a mathematical model, because it contains qualitative information, or if the solution is ambiguous (Berg and Kuhlmann, 1993; Oriade and Dillon, 1997). However, the assessment cannot be restricted to the understanding and simulation of a complex, dynamic system.

Apart from meeting general system requirements of criticality, sustainable development requires to avoid wasteful (inefficient) use of scarce resources. Moreover, it must be socially optimal in the sense that the outcome is acceptable for all members of a society. Therefore, economic efficiency and social equity should explicitly be addressed in the formal analysis.

To this end, we first need to reformulate the socio-ecological economic value function (social welfare function) as a weighted sum of individual utilities (Hediger, 1998c):

$$U = \sum_{i=1}^N \gamma_i \cdot u_i(y_i, M, S, Q)$$

For each individual i ($i = 1, \dots, N$), utility u_i is defined as a function of individual income y_i as well as the economic, social and ecological system conditions M , S and Q , that are the same for all inhabitants of a region. For the aggregation, individual utility weights, γ_i , are used. These weighting factors are fundamental for determining a social optimum which integrates economic efficiency and social equity requirements. They must be considered as normative element. Though these weights are *implicit* in a conventional economic framework of general market equilibrium, for ethical reasons, it seems more appropriate to use *explicit* utility weights. Such procedure is particularly justified in the presence of poverty and distributional concerns that are crucial for sustainable development.

To jointly address economic efficiency and social equity, along with general system requirements of sustainability (dynamics and criticality), the objective is to maximise over a given interval of time this weighted social welfare function U , subject to the above set of differential equations that describe the dynamic behaviour of the system, and subject to additional constraints of criticality. Given the presence of multiple state variables (compartments of capital), the solution of this intertemporal optimisation model is ambiguous, unless additional specifications are fulfilled (Pitchford, 1977; Chiang, 1992). These specifications can be formulated in terms of additional sustainability constraints. This may allow to analytically solve the overall problem through an iterative procedure of optimisation (Hediger, 1998a). Hence, a combination of simulation and optimisation procedures is adequate for the assessment of the regional opportunity space for sustainable development.

5. Participatory approaches to rural development

It has been shown that the concept of regional sustainable development can be translated into some value principle of weak sustainability and a set of safe-minimum standards of criticality. Emphasis has been given to the role of formal analysis for the assessment of these terms of

sustainability and evaluation of alternative development paths. Yet, this translation cannot exclusively be based on scientific knowledge, and, even more important, sustainable development cannot be achieved by a dictatorial approach. Rather, for various reasons which we discuss below, participation of local actors is required to enable and sustain the process of regional development.

Local actor's participation in the formal analysis (utility weights and functions)

Given potential trade-offs among goals, a choice must be made as to which objectives should receive priority, and thus greater weight, in the development strategy (Barbier, 1987). First, we need to reformulate the definition of weak sustainability, with reference to the weighed sum of individual utilities that has been proposed in the last section. Correspondingly, *weak sustainability* has an individual component (Hediger, 1998c). For constant population N , it is defined as the weighed sum of intertemporal changes of individual utility,

$$\dot{u}_i = \frac{\partial u_i}{\partial y_i} \dot{y}_i + \frac{\partial u_i}{\partial M} \dot{M} + \frac{\partial u_i}{\partial S} \dot{S} + \frac{\partial u_i}{\partial Q} \dot{Q}$$

and an additional term which results from possible change of individual utility weights:

$$\dot{U} = \sum_{i=1}^N \gamma_i \cdot \dot{u}_i + \sum_{i=1}^N \dot{\gamma}_i \cdot u_i \geq 0$$

Two important elements need to be addressed in this context. The first one is the need to determine utility weights γ_i for each individual, or homogeneous groups. The second issue is the assessment of individual or group utility functions, or the evaluation of marginal utilities. The latter are the weighting factors ($\partial u_i / \partial y_i$, etc.) that are crucial for the calculation of individual improvements, or utility losses. These priority weights can be assessed in a participatory approach with adequate representation of local stakeholders. Adequate methods are questionnaires, interviews, and group discussions (Schnell et al., 1993).

Finding a common platform for decision making and regional capacity building

Local stakeholders encompass all the people that are involved in the development process and effected from the consequences of change, as well as external representatives of political institutions and scientific groups that can have substantial influence on the development process. The participation of these stakeholders in the formulation of development goals and social priorities is crucial for local sustainable development, which requires a continuous process of change, through innovation and adaptation to new circumstances. This implies a need for local actors to continuously search for new development potentials within their

region, and to choose pro-active strategies, rather than to react to political, social, environmental and economic change. For regional sustainable development, this requires collective decisions and co-operation at a “higher level of social aggregation”; this is, above the level of a single family, firm or institution. For this purpose, the local stakeholders must find a “platform for common decision making” (Röling, 1994).

The application of participatory approaches and methods—like Participatory Learning and Action (PLA) and Rapid Appraisal of Agricultural Knowledge System (RAAKS)—has proven very useful for the creation of such platforms in rural areas. RAAKS is an action-research approach for studying innovation-related problem situations and for designing possible courses of action (Engel, 1995). It is based, on the one hand, on innovation theory (Rogers, 1983), operations research and soft systems thinking (Checkland, 1989); and, on the other, on practical experience in several projects in developing as well as highly developed European countries (cf. Engel, 1995). Various projects have shown potentials of co-operation between local actors and scientists in the formulation of common goals and action plans for regional development.

However, experiences with participatory methods have shown that they can only be successful if the participants have a minimal awareness of their interdependence, and if they share at least common general views about the development of their region. Otherwise, it is important to initiate a joint learning process to make visible different and common interests of different actors, and facilitate the agreement upon common objectives (cf. Dorenbos and Brunner, 1997).

The RAAKS methodology, for instance, offers a frame and tools to support the different steps that are necessary to improve the mutual understanding and to find common interests among stakeholders. The resulting local platform can then serve the stakeholders to identify unused potentials of development, and even find new ones. The creation of such development potentials depends, amongst other factors, upon the social competence of those people that are actively involved in the process of development and regional capacity building. The latter is strongly related to the reinforcement of regional identity which is an important factor for strengthening regional competitiveness (Bernet et al., 1998). To support the process of development and capacity building, priority should be given to the creation of an innovative climate which can prevail if competition and co-operation within the region are well balanced (Theler, 1996). This can help to expand the regional opportunity space for sustainable development, and hence to support regional development from inside.

Local arrangements for sustainable development

Once objectives are agreed amongst the different stakeholders, arrangements must be made to share responsibility for future actions and necessary tasks, like the control of land use arrangements and regulations, administration and marketing activities. This requires a permanent, flexible and neutral institution to enable a continuous discourse and process of innovation and change. Ideally, this new platform should include members of all interest groups, be neutral and stay open for all interested actors of all levels of action.

The fact that local actors can actively participate in the formulation of development goals, articulate individual and local knowledge, and express values and ideas, is a precondition for motivating them to contribute with their own capacities and competence to the development process. This is a precondition for an effective management of human resources, like education, knowledge and know-how, social competence, time and motivation, etc. For sustainable development of rural areas, human resource management is equally important as the management of natural and manufactured resources. Indeed, any development effort, though respecting general system requirements of sustainability, may wane quite soon, if it would not include local stakeholders from the beginning. It would not have support from those people that finally implement development strategies in practice, and that share responsibility for the overall management of the entire regional capital. For this reason, local stakeholders must be strongly integrated in the development process which, in the end, should be “theirs”.

6. Synthesis and conclusion

Sustainable development of rural areas requires socio-economic change that does not undermine the long-term objective of maintaining some suitably defined aggregate of regional assets intact over time. This embraces economic, ecological and social objectives, like regional competitiveness, full employment, and income growth per capita, sustainable use of land and ecological resources, and a decentralised settlement structure. One problem of rural development is that these objectives cannot be met immediately and without cost. They involve trade-offs, and require social and individual choices to be made.

A key challenge for rural policy is to strike the right balance between the short-term goals of improving regional competitiveness and employment, and rather long-term concerns about social, economic and environmental integrity. This requires local actors to allocate their resources in a way which is adapted to changing local conditions of the economic, social and ecological system, and to the economic and political context at the national and global scale.

To effectively manage this process of change, individual and social decision makers must be aware of social objectives, values and norms, general system requirements of sustainability, as well as methods and measures to initiate and realise change. This requires to have an overall perspective and understanding of the socio-ecological-economic system, including the bio-physical and socio-cultural sphere, and local competence and capacities to act adequately. Since this involves two different perspectives, we propose a combination of two epistemologically different approaches, as illustrated in Figure 1.

Figure 1: Combination of “top-down” and “bottom-up” approaches

Approaches	Objectives, values and norms	General system requirements	Realisation of change
Formal analysis (“top down”):	Social welfare ↓	Efficiency and equity, system dynamics, terms of sustainability ↻	Technological progress and structural change (endogenous) ↓
Regional sustainable development			
Participatory approaches (“bottom up”):	↻ Values and norms: Individual, ethical and cultural foundation	↑ Social capital and local ecological knowledge	↻ Local action: innovation and implementation of measures, institutional change

Formal analysis is crucial for the assessment of consistent terms of sustainability that define the boundaries of the regional opportunity space for sustainable development. These terms are not fixed in space and time, but result from the structure and dynamic behaviour of the overall system. Therefore, the terms of sustainability should represent system-inherent requirements, rather than express attitudes, and should serve as guidelines to the local actors which finally implement measures to realise change.

The terms of sustainability must be assessed for each location and moment in time through an adaptive process of evaluating trade-offs across the entire set of social, economic and ecological system goals (cf. Barbier, 1987; Hediger, 1998b, 1998c). In principle, this can be translated into an intertemporal allocation model of maximising social welfare, subject to the entire set of differential equations that represent the dynamic economic, social and ecological

system, as well as additional constraints that include local norms and exogenously determined levels of criticality. Given the complexity of the entire system and the presence of multiple state variables (ecological, economic and social capital), we propose a combination of optimisation and simulation models to assess consistent terms of sustainability (boundaries of the opportunity space for sustainable development) and analyse impacts upon different parts of the system. The results of formal analysis should serve as guidelines for regional sustainable development, rather than prescribe a development path.

Participatory approaches are necessary to integrate local stakeholders in a social discourse, and to facilitate the process of regional capacity building and “managing change” within the opportunity space for sustainable development. On the one side, this may improve the acceptance of scientific results, and help to agree upon policy targets and norms that are based on these results. On the other side, it allows to collect information about social capital, local knowledge and system understanding, cultural values, and local goals for economic and social development. This is useful information that needs to be integrated in the formal analysis. In addition, participatory approaches are important for regional capacity building and realising change. They provide a platform for social discourse, that can facilitate the reinforcement of regional identity and the creation of an innovative climate. The latter is crucial for the emergence of new development potentials and, thus, the expansion of the regional opportunity space for sustainable development.

In sum, we propose a combination of formal analysis and participatory methods as adequate for research on sustainable development in rural areas, and assistance to local actors and the political process. To provide a coherent set of information, formal analysis must integrate scientific knowledge with local knowledge, cultural values, and policy goals of economic and social development that are formulated at the local and national scale. We can then make use of optimisation and simulation methods that, if suitably combined, are adequate for assessing the boundaries of the regional opportunity space for sustainable development. These results should serve as “sustainability guidelines” to the local actors which finally implement measures to manage change at their respective level of activity. Participatory approaches can facilitate this process of change and provide a platform for social discourse and regional capacity building. To carry out such combined approach, co-operation will be required among scientists from different disciplines, extensionists, and local stakeholders. Finally, the conceptual framework must be adapted to the specific regional context.

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