

Zusammenfassung

Im Rahmen des Förderschwerpunkt Sozial-ökologische Forschung des Bundesministeriums für Bildung und Forschung haben sechs Forschungsprojekte Bedingungen und Strategien nachhaltiger Entwicklung im Handlungsfeld „Landwirtschaft und Ernährung“ untersucht. Diese Projekte deckten die Bereiche Landwirtschaft, Verarbeitung und Vermarktung von Lebensmitteln sowie Konsum ab und kooperierten in einem Kompetenznetzwerk, in dem sie ihre Methoden und Ergebnisse diskutierten. Im ersten Teil des Diskussionspapiers wird der konzeptionell-methodologische Ansatz sozial-ökologischer Forschung dargestellt, der charakterisiert ist durch a) den normativen Bezug auf das Leitbild nachhaltiger Entwicklung, b) eine integrative Perspektive bei der Bearbeitung von Nachhaltigkeitsproblemen und c) ihr gestaltungsorientierter, partizipativer Ansatz. Im zweiten Teil werden einige Ergebnisse aus den Forschungsprojekten zu drei zentralen Akteursgruppen und Bereichen des Handlungsfelds „Landwirtschaft und Ernährung“ vorgestellt:

- Unternehmen in Landwirtschaft, Verarbeitung und Handel,
- Konsumentinnen und Konsumenten sowie
- Diskurse und Politik.

Diese Ergebnisse werden aufeinander bezogen, einzelne Handlungsstrategien abgeleitet und die Herausforderungen transdisziplinärer Nachhaltigkeitsforschung reflektiert.

Summary

Within the German Social-Ecological Research Programme, six projects analysed conditions and strategies for sustainable development in the field of “agriculture and nutrition”. These projects, covering agricultural production, food processing, marketing and consumption, cooperated in a research network, discussing their methodology and results. In the first part, the discussion paper describes the conceptual and methodological approach of social-ecological research, which is characterised by a) explicit reference to the normative concept of sustainable development, b) an integrative perspective in dealing with sustainability problems, and c) a participatory approach that addresses practical problems. In the second part, some results of the network projects are presented for three primary components of the field of “agriculture and nutrition”:

- enterprises from the agriculture, food processing, and food marketing sectors;
- consumers; and
- discourses and policies.

These results range from systemic analyses to practical recommendations for specific actors, such as politicians, farmers, or consumer organisations. Finally, results were linked across actor groups and suggestions are made for sustainability strategies. Against this background, challenges of transdisciplinary research for sustainable development are reflected upon.

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1 Introduction: Sustainability problems related to food production and consumption

Sufficient, healthy, and tasty nutrition is a basic human need. The ways in which we eat and drink are part of human culture. At the same time, the production of food is closely linked with the natural environment and ecological cycles demonstrating our dependence on nature. Altogether, food production and consumption form a complex system that is an integral part of our daily life.

On a global scale, this system has changed considerably over the last 50 years. Some far-reaching, long-term transformations can be observed in the field of "agriculture and nutrition". Today, agriculture and food production are becoming more and more integrated into multi-level markets, flows and actor networks. Agricultural production and yields have been increasing due to the expansion of arable and irrigated land and the intensification, even industrialisation, of farming. As a consequence of these developments, food security has increased in many countries. The globalisation of food markets has increased long distance trade, resulting in complex commodity flows and division of labour systems. International competition demands low prices, large volumes, standardisation, specialisation and high production efficiency from agricultural systems (TAPPESER et al. 1999; MORGAN et al. 2006).

Industrialised countries, such as the EU member states and the United States, are a driving force in these global trends, because of their financially strong food markets and highly subsidised agriculture. In such countries, food production and consumption are constantly modernising: driven by technological development, changing life-styles as well as political interventions. As a result, a complex system of food production has evolved which produces ever-more efficiently and provides an outstanding variety of food at historically low prices in industrialised countries. On the other hand, this system of production and consumption is at least partly detached from its natural and social context. Agricultural intensification causes overexploitation and negative effects, such as soil degradation, water pollution, a loss of biodiversity, climate change, and reduced standards of animal welfare (KNUDSEN et al. 2006). Over-consumption and unhealthy diets are contributing to an increase of endemic illnesses, such as obesity or cardiovascular diseases, while food scandals undermine consumers' trust in food production (MORGAN/SONNINO 2007). Obviously, some of these developments constrain sustainable food production and nutrition. How can the basic need for food be met without compromising the environment, other regions, and future generations? What are the primary challenges for moulding these fundamental trends towards sustainability in the long run?

The Social-Ecological Research Programme of the German Ministry of Education and Research analyses problems that accrue from the relations between humans, society and environment, especially those that endanger their sustainability. Social-ecological research strives for a comprehensive understanding of such problems. For this reason, it analyses current patterns of production and consumption, considering their social, political and cultural contexts. On the one hand, it integrates knowledge derived from different disciplines and practical ('on the ground') experiences in order to elaborate feasible solutions. On the other

hand, it raises normative questions concerning the objectives of sustainable development (BALZER/WÄCHTER 2002; BMBF 2007). This approach was applied to agriculture and nutrition in Germany, covering, food processing, marketing, consumption and health. Within the Social-Ecological Research Programme, six projects have recently analysed the area of "agriculture and nutrition" and cooperated in a research network.

This paper draws on some of the manifold results of these projects, trying to provide an overview of them. At first, it describes briefly the research network, explains the social-ecological conceptual approach and discusses how it can be contextualised with regard to a thematic research topic (section 2). Then, empirical results from the research projects are presented with regard to three main domains of "agriculture and nutrition": a) enterprises from the agriculture, food processing, and food marketing sectors, b) consumers, and c) discourses and policies (section 3). In the last section, conclusions are drawn concerning conceptual and methodological challenges for social-ecological research and suggestions are made for long-term-oriented governance strategies towards sustainable agriculture and nutrition (section 4).

2 The conceptual approach of social-ecological research on "agriculture and nutrition"

In this section, the research network and its background is described first. Further subsections introduce the conceptual and methodological approach of the projects and, finally, discuss how it can be applied and contextualized to the field of "agriculture and nutrition".

2.1 The research network on agriculture and nutrition

Six recent research projects within the Social-Ecological Research Programme of the German Ministry of Education and Research analysed questions of food production and consumption in Germany, dealing with conventional and organic agriculture, food processing, marketing, nutrition, and health questions. In order to generate synergies, they cooperated in a research network from 2003 until 2007, discussing the methodology and their results. The individual projects are as follows:

- Food change: Strategies for socio-ecological transformations in the field of environment-food-health (www.ernaehrungswende.de)
- OSSENA – Nutritional Quality as Quality of Life: An action-analytical approach for the evaluation of possible changes in nutritional cultures (www.ossena-net.de)
- From the turnaround in agrarian policy ("Agrarwende") to a turnaround in consumption patterns? A study along the food supply chain, from stable to table (www.konsumwende.de)
- Regional Wealth Reconsidered: The contribution of the organic agriculture and food sector towards quality of life (www.regionalerwohlstand.de)
- PartizipA: Participative Modelling, Analysis of Actors and Ecosystems in Agro-Intensive Regions (www.partizipa.net)

- AgChange: Conflicts in the New Agricultural Policy (www.agchange.de)

In the beginning, the project “Developing Agrobiodiversity! Strategies and impulses for sustainable animal and plant breeding” (www.agrobiodiversitaet.net) participated in the network too, until it ended in 2004. This range of projects resulted more or less coincidentally, because they were chosen from several calls for tender. As a consequence, the network did not claim to analyse the thematic field systematically and comprehensively. However, the research projects represented a large variety of perspectives on and methodological approaches to the topic, while combining manifold disciplinary competences. The motivation for cooperation between projects reflected awareness of the new approach towards social-ecological research and was an endeavour to contribute to a more sustainable agriculture and nutrition. All the projects were finished in 2006 and 2007, with the cooperation ending after a conference and the publication of a book (NÖLTING/SCHÄFER 2007b).

2.2 Characteristics of the conceptual approach of social-ecological research

The general concept of the Social-Ecological Research Programme is explained in the “framework concept” (BMBF 2007). The research perspective is described by Becker/Jahn in detail (BECKER/JAHN 2000; 2006). As this new approach is very ambitious, a broadly approved conceptual and methodological framework has not been established so far. Therefore, real-world problems are a challenge for such research projects. Taking a problem-oriented approach, each project has to develop a specific research agenda. Nevertheless, some common characteristics of the network projects can be identified that contrast with mainstream agricultural and nutritional research in Germany (BRAND 2007):

- a) making explicit reference to the normative concept of sustainable development,
- b) taking an integrative perspective in dealing with sustainability problems, and
- c) using a participatory approach that addresses practical problems.

a) Reference to the normative concept of sustainable development

All of the research projects of the network referred explicitly to the normative concept of sustainable agriculture and nutrition. Yet, at first, they were confronted by a plurality of visions and diverging, even contradictory, interpretations of sustainability. Moreover, the realisation and implementation of these visions often provoke conflicts of interest and debates about values. As a consequence, each projects needed to clarify which of the rival definitions of sustainability they held and what their position on these conflicts and debates was. Additionally, they had to explain their scientific roles in dealing with societal conflicts and normative debates. In taking these steps, they a) analysed conflicts over goals, b) initiated disputes about the values and goals appropriate to sustainable development or c) moderated between conflicting parties. By doing so, they called reigning visions in agriculture and nutrition into question and

confronted them with values related to sustainable development. Most of the projects reflected on their position explicitly and made their choices and selection criteria transparent. By doing so, they integrated conflicts about norms and goals into the research process trying to develop constructive solutions for these conflicts (BRAND 2000a; NÖLTING et al. 2004). Following such a thorough deliberation on normative questions, researchers are then able to feed the generated results into societal processes of defining goals and visions as well as decision making.

b) Integrative perspective

The researchers took an integrative perspective on sustainability problems, combining scientific knowledge from several disciplines with that derived from practitioners' experience in order to generate sufficiently complex, systemic knowledge, because these problems do not stop at disciplinary boundaries. The search for feasible solutions formed the integrating focus of the social-ecological research projects. This required an understanding of the whole value-added chain as well as of nutrition as its counterpart. The largely separate realms of agricultural and nutritional research were combined in some of the projects, and the different perspectives and results were confronted with each other in the network.

c) Participatory, transdisciplinary approaches

Participatory approaches help to link the analysis closely with practical sustainability problems in order to develop feasible strategies for every day life. Such strategies and practical recommendations can only be successful if their political, social and cultural context is adequately reflected upon in terms of e. g. possible opposition and obstacles, scarce resources or implementation problems. For this purpose, qualitative research is most well suited – even more effective when it includes the participation of practitioners, stakeholders and affected groups. This includes a thorough examination of the goals, planning and implementation of the research process as well as the realisation of pilot projects by researchers and practitioners. This kind of transdisciplinary research is not easy for either side, but it widens the analytical perspective and can adapt it to practical challenges. As a consequence, the research projects stayed very close to real world problems, and sometimes they found themselves in the midst of the societal conflicts, diverging perspectives and valuations connected with them.

The research projects fulfilled distinct functions in process. Some of them cooperated directly with enterprises, consumers' organisations, ministries and administrations in order to initiate practical activities and projects by action research (PFRIEM 2006), e.g. the introduction of regional products in local supermarkets (UPHOFF 2007). Other projects concentrated on the exchange with stakeholders and a common evaluation of problems and activities. For example, considering the perspectives of consumers in their everyday life contexts is crucial for a better understanding of their nutritional habits and patterns (EBERLE et al. 2006). In a third approach, projects initiated and moderated deliberation on conflict-generating topics such as the application of the EU Water Framework Directive (NEWIG/KALDRACK 2007) or new trade agreements regarding sugar

between the EU and developing countries (GOTTSCHICK/MÜLLER 2007). Actors who were integrated into the research process adopted the perspective of sustainable development more openly and considered related strategies relevant for their daily businesses.

However, researchers and practitioners such as entrepreneurs, politicians or administrators act according to different logics and criteria for success. Therefore, transdisciplinary sustainability research is faced with the double challenge to translate real life problems into questions for scientific research and to formulate solutions or recommend actions for praxis which can have an impact outside science (BRAND 2000b). The projects had to find a balance between scientific and societal demands and had to address both in order to solve sustainability problems effectively, because social-ecological research does not strive to develop strategies which only describe what should be done, but what can be done.

In sum, social-ecological research does not focus on single, disconnected aspects of food production and nutrition, but rather analyses relevant sustainability problems in relation to overall systemic conditions as well as the specific contexts of particular problems. The integrative analysis and an intense relation with lay practitioners complement one another, thus going beyond disciplinary research.

2.3 Thematic approach: the field of “agriculture and nutrition”

How can this conceptual approach be applied to food production and consumption? The German food production and consumption system reflects global trends and is indicative of problems in other industrialised countries, but is also embedded in a specific national-regional, societal and environmental context. Therefore, developments in this domain are heterogeneous, and it is not an easy task to classify them as “sustainable” or “un-sustainable”.

There are various definitions of sustainable agriculture, making it often a matter of interpretation. The widely accepted guidelines of the FAO define sustainable agriculture as being economically viable and socially responsible; it must be geared towards conserving land, water and genetic resources for future generations. Meanwhile, the discussion about sustainable nutrition has only begun recently. The project “Food change” suggests the following definition: Sustainable nutrition is environmentally friendly, healthy, satisfying nutritional needs and contributing to life quality. Food supply should correspond with daily life routines and foster socio-cultural diversity (EBERLE et al. 2006, p. 54).

Referring to these definitions, some persistent problems of food production and consumption in Germany can be briefly sketched out. Intensive agricultural production causes environmental problems (UBA 1997, p. 118-134). Despite strict public standards with regard to food safety and an increasing numbers of private labelling and quality management systems, food chains are becoming less and less transparent to consumers, and recurrent food scandals have reduced consumers’ trust in food production (EBERLE et al. 2006, p. 67-72). The diversity of nutritional patterns has increased considerably over the last decades; fast food, convenience food, and functional food are just some examples of this

(RAABE 2006). In contrast, the nutritional skills required to ensure healthy diets and cooking are partially eroding and over-consumption is affecting consumers' health (RÖSCH/HEINCKE 2001).

How can these diverse problems, dimensions, and perspectives be integrated conceptually? How can social-ecological research realise a comprehensive and integrative analysis? A bridging concept is the field of "agriculture and nutrition", which connects food production and nutrition, stressing that both aspects are inextricably connected with each other, even though agricultural and nutritional research are generally separated. Together, they form a production-consumption system which is characterised by material, economic and symbolic flows between two poles: the production of raw materials and the consumer's plate. These flows move downstream from production to consumption and upstream, and materials, information etc. are or might be transformed at each step in both directions (PRINCEN et al. 2002; LEBEL 2005; HOLLOWAY et al. 2007). The market for food is neither merely driven by enterprises trying to manipulate consumers nor is it a place where consumers reign undisputedly. Rather, the market is constituted culturally as an arena of constantly interwoven interactions between supply and demand (PFRIEM 2006, 49). Production and consumption are interdependent and our "food choice has multiple implications – for our health and well-being, for economic development at home and abroad, for the ecological integrity of the global environment, for transport systems, for the relationship between urban and rural areas" (MORGAN et al. 2006, 1).

Analytically, however, it is sensible, for pragmatic reasons, to analyse the field of "agriculture and nutrition" from both perspectives, because each domain has its own rationality and follows a distinct logic. Further, the central actors and stakeholders involved are different: enterprises and policy, on the one hand, and consumers on the other hand. The confrontation of both research perspectives widens the analytical focus and helps to uncover "blind spots".

Finally, production and consumption of food are not isolated events, but are rather influenced and shaped by framework conditions. Policy, of course, is important because of its central impact on regulatory frameworks. The public is another crucial aspect of these conditions, framing discourses and norms with regard to food, agriculture and nutrition.

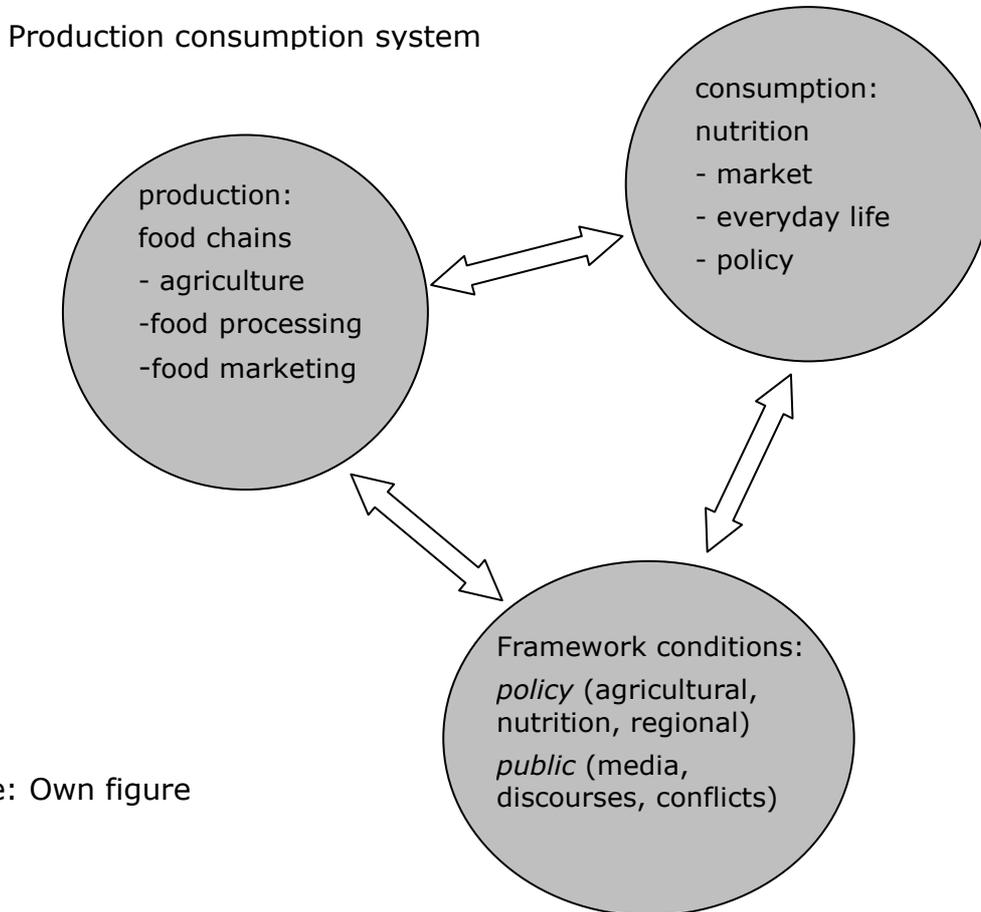
The transition towards sustainable development requires new policy goals for the field of "agriculture and nutrition" including a redistribution of resources and opportunities. Consequently, the development of a new agrarian policy in Germany during and after the BSE-crisis aroused fierce struggles from a number of sides (KUHNERT et al. 2005; GERLACH et al. 2006; REHAAG/BRUSE 2007). Because discourses and visions are an indispensable component of any political steering process (BRAND/FÜRST 2002), framework conditions form a third analytical perspective.

Thus, for an integrative approach towards the field of "agriculture and nutrition" the following three research perspectives are deemed adequate for exploring and analysing the field of "agriculture and nutrition" (BRUNNER/SCHÖNBERGER 2005; NÖLTING/SCHÄFER 2007b):

- food production

- consumption/nutrition
- framework conditions (see figure 1).

Figure 1: Conceptualisation of the field of “agriculture and nutrition”



The relationships between these three domains are mediated by institutions. Geels, for example, underlines the role of institutions in the concept of socio-technological systems, pointing out that any change in one of the domains provokes adaptations and reactions in the others (GEELS 2004). Institutions shape these reactions and adaptations – and are transformed by them at the same time. Because of the complex interrelations involved, single political interventions are not sufficient for achieving sustainable development. A long-term strategy is needed, all the more as consumption patterns are deeply rooted in a nutritional culture to which consumers are often oblivious (PFRIEM 2006). Additionally, people have to manage nutrition in their everyday lives subject to time, money, knowledge, accessibility and other constraints (EBERLE et al. 2006). Therefore, any strategy to overcome sustainability problems has to reflect this contextual and systemic character. Reflexive governance (VOß et al. 2006), transition management (LOORBACH 2007) and learning processes are needed in order to foster long-term governance for sustainable food production and consumption.

The attempt to make a complete and thorough analysis of the complex field of “agriculture and nutrition” would certainly overburden a single social-ecological research project. In many respects, this holds as well for the described research network of only six projects, which were selected more or less coincidentally and did not intend to cover the whole field systematically. However, the projects cover a broad range of relevant domains (see table 1). For this reason, the research network was able to bring together results from different disciplines and perspectives, and reference to the field of “agriculture and nutrition” provided a strategic research perspective for the projects, helping them to position themselves in the broader field of research. On this basis, findings, practical recommendations for actors, and strategies could be linked across the projects, thus, allowing “blind spots” to be discovered, while providing strategic starting points for sustainability action. This degree of thematic cooperation is, so far, unique in the Social-ecological research programme of the German Ministry of Education and Research.

Table 1: Overview of research topics on “agriculture and nutrition” of participating social-ecological research projects

Projects	Food change	OSSENA	Turnaround in consumption patterns	Regional wealth	AgChange	PartizipA
production-consumption-system	Yes, from the consumption side	Yes	Yes, for organic food	Yes, for organic food from the production side		
whole production chain		Yes (regional)	Yes (organic)	Yes (organic)		
- agriculture		Yes	Yes	Yes	Yes	Yes
- processing		Yes	Yes	Yes		
- marketing		Yes	Yes	Yes		
Consumption/nutrition	Yes, consumers' perspective	Yes	Yes	(Yes)		
policies	nutrition policy		Yes (as framework conditions)	Yes (as framework conditions)	agricultural policy	agricultural policy
public debates	Yes	Yes	Yes		Yes, discourse analysis	Yes, conflict management
scale	national	regional	national	regional	international context	regional
practical implementation	policy recommendations	pilot projects, action research	policy recommendations	Practitioners' advisory council, pilot projects	policy recommendations, participatory assessment	platform of regional stakeholders, participatory assessment

Source: Own table

3 Results from the social-ecological research projects

It is impossible to discuss here in detail the full range of results of the six research projects (for an overview, see NÖLTING/SCHÄFER 2007b). Instead, some exemplary results are presented according to the above-mentioned analytical perspectives:

- enterprises from the agriculture, food processing, and food marketing sector;
- consumers; and
- discourses and policies.

3.1 From sustainable products to sustainable enterprises

Enterprises not only from agriculture, but also from food industries and food marketing, are closely linked with the natural environment, ecological cycles and the needs of the human body. Their methods of production and products are highly influential on the environment and human health. Hence, for the past 20 years there has been an ongoing debate in this field about environmentally friendly production, and, more recently, about fair trade and corporate social responsibility (CSR). The challenge for sustainability research is to link together the accumulating impacts on sustainable development that occur along the production chain: from agriculture through food processing to food marketing. These production chains include many different economic and productive activities and exchanges over the whole globe (ERMANN 2005; MORGAN et al. 2006). Some of the network's projects analysed entire production chains for organic products (Turnaround in consumption patterns), for example, or on a regional scale (OSSENA, Regional wealth). Together, the projects covered all of the important links related to such food chains as they presently exist in Germany (see table 1).

They analysed how modes of production can contribute to the development of sustainable products, exploring in addition how the activities of enterprises can have impacts beyond the market. The hypothesis was that strategies for sustainable food production have to enhance the position of sustainable enterprises both in the market and in society.

Project results reveal that small and medium enterprises (SMEs) that are pioneers of sustainable economy as well as large enterprises that are established in the "conventional" food market can promote sustainable development via the market. They produce and trade in food that is, for example, organically produced or of regional origin, fostering regional nutritional culture. The companies play different roles according to the slogan "multiplying Davids, greening Goliaths" (WÜSTENHAGEN 2000, 129). Innovative pioneers – mostly SMEs – develop and introduce sustainable products to niche markets, while large companies might scale up their product lines, reaching a majority of the consumers. On the other hand, such large food companies are a sort of gate keeper for the introduction of a variety of sustainable products (and services), because they control an enormous share of the market. They are subject to the logic of the food market, which is dominantly driven by economies of scale and

fierce price competition in Germany, imposing considerable restrictions on the introduction of new products. Results from two projects describe the challenges in this domain.

First, the OSSENA project initiated the introduction of regional products on the shelves of a regional supermarket chain. The company and the research project jointly and successfully resolved logistical problems that are generally considered to be the main restriction on regional products: small quantities are supposed to increase costs too much. The analysis, however, revealed cultural mismatches to be the main restriction on the successful introduction of new regional products. Indeed, it was already possible to fit the new type of regional, sustainable products into the normal procedures and structures of the supermarket, but they had not been promoted with the necessary enthusiasm or conviction. The personnel, from top managers to salespersons, had not been praising the specific qualities and benefits of regional products enough in order to convince consumers to buy them (UPHOFF 2007).

Second, the project "Turnaround in consumption patterns" developed, in close cooperation with stakeholders and market actors, a guiding vision for achieving sustainable, though highly processed, organic foods. Thus far, convenience food has been regarded as a symbol for non-sustainable trends in the food market. Considering the increasing demand for such products, however, it seemed as a first step sensible to describe sustainability criteria (e.g. environmentally friendly production, fairness, health aspects, economic viability) for this market segment in order to provide orientation for producers and consumers. Then, in a second step, the project tested some organic convenience products against these criteria, revealing that these organic products fulfilled only some of the stated requirements and concluding that these products – although already organic – can still be improved in terms of sustainability (RIEGEL/HOFFMANN 2006).

Parallel to the goings on in the market, economic activities are also embedded in a socio-cultural context (GRANOVETTER/SWEDBERG 1992; BIESECKER/KESTING 2003). Consequently, sustainable and unsustainable modes of production always have an impact on the society in which they operate. Two projects analysed these societal effects using the example of organic food production. Based on a broad understanding of the term "wealth", the project "Regional wealth" analysed the contribution of organic enterprises towards quality of life and sustainable development in the Northeast German region of Berlin-Brandenburg. The results show that organic companies produce in an environmentally friendly manner, create jobs and income, transfer knowledge and experiences about sustainable agriculture and healthy nutrition to consumers, participate in regional networks, and stabilise social resources in peripheral rural areas suffering from demographic decline and economic crisis. Especially the social effects of these activities remain, however, "invisible" to the public at large, even though they are more immediately important to peripheral rural areas in Eastern Germany than the environmental benefits are (SCHÄFER 2007).

The project "Turnaround in consumption patterns" analysed organic agriculture in two German regions (Mecklenburg-Vorpommern in the Northeast and Bavaria in the South) and developed a typology of organic farmers who can be

differentiated according to region, motivation and economic specialisation. The typology reflects the current differentiations within organic farming. Strategies for rural development can address the different types of farmers according to the various local and political challenges that they face (ENGEL/ULMER 2007).

Both projects point out that entrepreneurial activities entail more than just employing a sustainable mode of production (e.g. environmentally friendly, fair) and creating sustainable products (e.g. healthy). These activities are, rather, complemented by societal effects that are not necessarily determined by market activities (SCHÄFER et al. 2008). In fact, the social contexts of organic firms and their positions within the market are corresponding, mutually relevant factors. A sustainable profile can be an asset for some enterprises, mainly those in niche markets. However, trends in the German food market, such as severe price competition, are a severe drawback for sustainable food production. This underlines the importance of cultivating changes in consumption patterns as well as the need for support of sustainable enterprises through policy alteration and greater public awareness in order to scale-up sustainable food production.

The network projects' recommendations and suggestions for action to be taken in order to support sustainable enterprises can be subsumed under two strategic perspectives. Firstly, the communication of the specific features and qualities of sustainable food should make its positive effects visible. At the same time, sustainability communication should complement marketing activities; thus combining economic chances with social reputation. Building networks is a second strategy for strengthening sustainable enterprises through alliances and cooperation, which can also include organisations from civil society. Government can initiate and support such networks, e.g. through programmes like LEADER. It is still an open question whether these strategies can strengthen the market position of sustainable enterprises – even against economic trends that are not favourable to sustainable development, such as an increasing functional and geographical division of labour and specialisation along global food chains (TAPPESEER et al. 1999; VINZ 2005).

3.2 Consumption: Taking the perspective of consumers seriously

Consumers, as the complement to enterprises, shape nutritional habits through life styles and consumption styles. Their role, however, is much more ambiguous than the role of companies, because consumers form a highly heterogeneous conglomeration. As a consequence, scientific research, public discussion and government often sketch quite shallow, unreliable images of consumers. On the one hand, they are seen as being well-informed, sovereign consumers powerfully shaping markets, on the other hand, they are described as being helpless, defenceless consumers manipulated by advertising, drowned by information about the "right" foods and diets and patronised by consumer consultants. Moreover, the public debate about the characteristics and norms of sustainable nutrition is in its initial stage (REISCH 2004). In this vein, the afore-mentioned definition of sustainable nutrition provided by the project "Food change" is an important contribution to structuring the field of nutrition.

Against this background, it is a central finding of social-ecological nutritional research that nutritional policy, consumer information, and nutritional advice only have a meaningful impact if they seriously take on the perspective of consumers, something which has thus far been neglected (BÜNING-FESEL 2007). The projects' results underline that consumers do not orient their nutritional practices solely toward achieving economic cost-benefit maximisation or comprehensive information. As "competent" consumers, they rather manage their nutrition within the constraints of a complex everyday life (HAYN 2007) and according to deeply rooted nutritional cultures and patterns (RAABE 2007). On the other hand, they have to select from a multitude of dietary options.

Projects focused on the everyday perspectives of consumers. The project "Food change" differentiated among consumers in order to address specific target groups. It identified seven nutritional styles with strongly diverging capacities and problems, arguing that any strategy for sustainable nutrition has to take into consideration this multiplicity and must accordingly design different approaches for specific target groups (EBERLE et al. 2006).

The OSSENA project developed the concept of nutritional culture being the driving – or hampering – force for a transition towards sustainable nutrition (PFRIEM 2006). Nutritional culture is defined by consumption practices that were analysed by action research. The project initiated interventions into the regional nutritional culture that had been uncovered. Pilot projects covered all aspects of the production chain, such as agriculture and supermarkets, school meals, a regional network of restaurants with typical regional menus, and culinary events such as public meals (Ostfrieslandmahle). The interventions hooked up with existing practices, some developed them even further, explicitly extending or contrasting them. The project interpreted and analysed reactions to these interventions and tried to institutionalise the successful ones (PFRIEM et al. 2006).

These results underline that consumers are not in the position to change the field of "agriculture and nutrition" solely through autonomous decisions at the checkout counter; rather, they need support structures in order to change consumption patterns and diets. This insight is reflected in the project "Turnaround in consumption patterns", which developed an integrated model of action that addresses the perceptions, knowledge, motivations and actions of consumers simultaneously, in order to motivate them toward eating more organic food. Such a campaign will only be successful, however, if it addresses the experiences of the target group and their everyday life contexts, instead of inundating them with information and "preaching" about the right diet (WILHELM/KROPP 2007).

Three strategies for enhancing sustainable nutrition can be deduced from the overall results of the projects. First, consumer communication should link up with consumers' daily life perspectives and re-orient traditional consumer communication and especially advertising towards sustainability topics. Such a sustainability communication needs to be differentiated according to the several target groups and contexts for which it is created; communication strategies have to go beyond cognitive forms in order to include experiential

communication such as product-related play or tasting.

A second, complementary strategy endeavours to make sustainable food and nutrition accessible and affordable for a broad majority. Easy access to sustainable food is a prerequisite for achieving meaningful changes in consumption patterns; this can be provided e.g. by organic companies, regional supermarkets or food industries processing organic convenience foods and promoting them via the above-mentioned communication strategies. Regional cooperation may be one option, for example in the way that the region of Brandenburg supplies organic food to its neighbouring city of Berlin (NÖLTING/SCHÄFER 2007a) or in promoting regional food at events such as public meals (Ostfrieslandmahl) in Lower Saxony and providing it at local supermarkets (OSSENA) (UPHOFF 2007). Offers for sustainable food supply could and should be bundled with other services related to nutrition, such as nutritional advice, cooking courses, and field visits, with the consequence that various commercial and non-commercial options and aspects of sustainable nutrition become available as a "package". Yet, both of these strategies aim at individual consumers and, therefore, risk putting the burden of all the responsibility for making nutritional changes on the consumer.

Avoiding this dead end, the third strategy is forming alliances and networks that mediate between the supply and demand sides. It is the task of these supporting networks to communicate consumers' interests to other stakeholders like food industries, food retailers, advisory organisations, health insurance providers, environmental organisations, politicians and administration, and vice versa. As long as nutritional policy has no clearly defined contours and it is not established as a policy domain of its own, the role of politics will remain ambiguous. It is, then, all the more important that responsibility between policy makers, producers, consumers and professional stakeholders (health insurance providers, nutritional consultants) in this field be shared (REHAAG/BRUSE 2007). This leads to an examination of the role of policy making and the public in the field of "agriculture and nutrition".

3.3 Policies and discourses: How to benefit from conflicts and diverging perspectives?

The activities of enterprises and consumers are embedded in a systemic context, with their interactions being influenced by policies and public discourses. Political regulations set framework conditions which may enhance or restrain sustainable development. While agricultural policy is highly regulated by laws, directives and subsidies at the EU and the national level, nutrition policy has hardly evolved in Germany, with the exception of consumer protection. Clear policy goals, strategic concepts, and policy networks are still lacking (REISCH 2004; EBERLE et al. 2006).

Independently of a high or a low degree of regulation, the impact of political steering of sustainability processes is limited because the normative goals involved are highly disputed, knowledge about system dynamics is lacking, and power as well as capacities are fragmented (VOß et al. 2007). Necessary changes for sustainable agriculture and nutrition entail reformulation of policy

goals and redistribution of resources and opportunities. Such changes arouse conflicts, and there is a fierce struggle going on in Germany over the redesigning of policy strategies and the reframing of public discourses on agriculture and nutrition. These conflicts seem to hamper progress towards sustainable development. As a consequence, sustainability research has striven towards identifying win-win-solutions over the long term.

Results from social-ecological projects confirm that there are considerably divergent interpretations and valuations, even deep conflicts, in the field of "agriculture and nutrition" (FEINDT et al. 2004, FEINDT/LANGE 2007). Interestingly, the projects do not consider these conflicts to be a dead end, but rather as a starting point for constructive problem solving. Two projects used group model-building and participatory sustainability impact assessment in order to gauge societal needs and wants. The project PartizipA initiated a stakeholder platform to discuss how the EU Water Framework Directive could be applied in a region with intensive agriculture (animal husbandry) in Lower Saxony (NEWIG/KALDRACK 2007). The project AgChange managed a participatory sustainability impact assessment of new Economic Partnership Agreements between the EU and developing countries with regard to a recent EU sugar reform (GOTTSCHICK/MÜLLER 2007). Both projects pointed out that participatory approaches stimulated learning processes and opened new ways for joint problem solving. They developed and tested new tools and methods for the governance of the kinds of conflicts where policy, using only hierarchical instruments, would be likely to fail – at least with regard to the implementation of such measures.

Political conflicts concerning sustainable agriculture and nutrition reflect underlying societal conflicts, which arise from a mixture of diverse, even rival, interests and valuations and are brought to light in public discourses that frame debates on societal goals and political decision making. The discourse on agricultural policy was high on the agenda in Germany during the BSE crisis and the ensuing "turn around" of German agricultural policy. This clash of opposing positions and norms in combination with food scandals – described in all their unappetising details in the mass media – opened a window of opportunity for new forms of policy and governance approaches. New stakeholders, who had until then been excluded from the establishment of agricultural policy, gained access to public debates and to decision making processes. Organic farmers' organisations, environmental associations and consumer protection organisations, as well as the Green Party, introduced alternative strategies to the debate, while at the same time provoking massive opposition from the established players. Altogether, these new discourses paved the way for new forms of governance over agriculture, with long-term effects.

By contrast, the discourse about sustainable nutrition is still very vague in Germany, mainly pushed along by food scandals and the plight of obese children. Policy is an important player in media discourses, but does not speak with a unified voice. Consumers do not have a voice in media debates because they are too heterogeneous, do not have established organisations representing their interests, and, finally, other stakeholders often mistrust the maturity of

consumers and tend to patronise them. Therefore, in media discourses consumers are “represented” by experts who know what they should eat. In short, the discourse on sustainable nutrition is still at an embryonic stage (REISCH 2004). In this context, the project “Turnaround in consumption patterns” analysed how semantic boundary objects, such as “animal welfare” or “purity of food”, can serve as bridging concepts that facilitate communication between diverse actors along the value-added chain: from organic farmers to consumers (SEHRER 2007).

With regard to the overall results of the network projects on discourse and policy, two primary strategies can be delineated. The first approach is the configuration of the communication and the structuration of conflicting discourses. The participating social-ecological research projects took into account the existing diversity of perspectives and the spectrum of value judgements, using them as sources of knowledge and motivation as well as making them a starting point for learning processes. The project “Food change” suggests that stakeholders, and especially of those in the political realm, should initiate and organise a systematic societal debate about the goals of “sustainable nutrition” and lay the foundations for nutrition policy. This should include sharing responsibilities between stakeholders, broad participation of affected actors, capacity building for actors from the state and civil society, and constructive management of food and health crises (EBERLE et al. 2006; REHAAG/BRUSE 2007). Other network projects developed and tested tools for constructive management of conflicts, new forms of communication about wants and needs as well as guiding visions for the food-processing industry or the organic food industry (see section 3.1).

A second approach is to improve political framework conditions. Even though government is only one actor among others, it can support sustainable enterprises, develop a form of consumer-oriented communication suitable for meeting their everyday requirements, or moderate the exchange between enterprises and consumers and their interests. Government can create the necessary preconditions and structures for reflexive governance of persisting sustainability problems (VOß et al. 2006). On the other hand, policies already in fact do regulate or influence some areas of agriculture and nutrition through traditional government instruments and programs. The impact of these interventions on sustainable developments needs to be further evaluated.

4 Conclusions: From transdisciplinary research to sustainability strategies

As the projects’ analyses have shown, the field of “agriculture and nutrition” faces considerable challenges with regard to sustainable development. Economic trends in global food production and marketing, nutritional culture, political conflicts and public debate about the goals of sustainability will all influence its further transformation: each domain following its own rationale while influencing the others at the same time. Thus, the transition towards sustainable agriculture and nutrition requires long-term governance strategies.

Summarising the results, some general suggestions for sustainable agriculture and nutrition have been made by the network’s projects. However, the network does not claim to have formulated a comprehensive societal program for social-ecological transition. Some projects analysed frontrunners of sustainable development, such as organic food production, regional food and new forms of consumer communication, and assessed the difficulties now being faced in expanding these sustainable niches. However, individual producers and consumers are not alone responsible for a transition towards sustainable food production and consumption. In fact, some enterprises and consumers are important pioneers of sustainable development by creating and innovating sustainable food or by moral consumption. As a consequence, long-term governance has to go beyond “heroic” individual behaviour and should support sustainable food production and consumption by appropriate institutions, actor networks and communication.

Further, the results and recommendations of the projects point out that social-ecological problems can be resolved neither by single measures nor by single concepts alone. Rather, the researchers, often together with practitioners, formulated and experimented with manifold instruments and described a broad range of strategies (see table 2).

Table 2: Strategic suggestions from social-ecological research for sustainable agriculture and nutrition

Enterprises	Consumers	Policy and discourses
<ul style="list-style-type: none"> - Greater communication of the societal benefits of sustainable food - Building networks of sustainable enterprises 	<ul style="list-style-type: none"> - Greater consumer-oriented communication - Increasing accessibility of sustainable food - Moderating stakeholder alliances 	<ul style="list-style-type: none"> - Coordination of communication, management of conflicting discourses, societal learning - Improving public framework conditions

Source: Own table

Two aspects seem to be especially important here in order to scale-up the findings on the particular cases: Communication on sustainable agriculture and nutrition stimulates reciprocal inter-linkages between knowledge, learning and action and has to focus on particular target groups in order to convey a complex message. Networks and cooperation bring together various actors who are

needed for integrative solutions, while also fostering mutual support and backing for sustainability frontrunners. At bottom, various instruments and strategies have to be combined, coordinated and adapted to the specific problems and contexts in question.

The results also stress that such strategies only can be successful if they are embedded in a specific context of action. The strength of social-ecological research lies in employing an interdisciplinary mode of analysis of sustainability problems, relating them to general framework conditions as well as to particular contexts and producing knowledge at the interface between science and society.

This socially robust research perspective provides new insights and points toward conceptual and methodological challenges for social-ecological research. Even though most of the projects adopted transdisciplinary concepts (BERGMANN et al. 2005; POHL/HIRSCH HADORN 2006), practitioners have not always been able to directly implement the recommendations and strategies generated thereby. They formulated rather different goals for the research process and societal transition in comparison to those of the researchers and could only selectively incorporate findings and recommendations into their daily life routines and strategic deliberation processes, especially if they had not been personally involved in the research process (BRAND et al. 2007).

The implementation of recommended actions is only possible in cooperation with practitioners. But it is quite unusual for researchers to actively participate in the implementation of, for example, pilot projects. This is by and large not seen to be the proper domain of research projects, and such researcher participation provokes role conflicts and debates concerning standards of scientific objectivity (BRAND 2000), thus revealing the limits of transdisciplinary research. However, becoming involved with tackling real world problems is one of the assets of social-ecological research which, while exploring problems and challenges beyond the boundaries of traditional disciplinary research, actually promotes sustainable development in real life situations. Nevertheless, the problems of knowledge transfer into the practical domain and questions about the diffusion and institutionalisation of sustainability innovations is still on the (research) agenda. Network projects dealt with these questions and were able to provide some valuable insights on them. Therefore, in order to reap both scientific and practical benefits, we suggest that the introduction of sustainability strategies into real world contexts needs to be evolved further within social-ecological research programs (ZHRNT 2007).

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