Sustainable local food production and consumption – Challenges for implementation and research

Martin Schönhart, Marianne Penker, Erwin Schmid

University of Natural Resources and Applied Life Sciences (BOKU), Doctoral School Sustainable Development (dokNE), Wien, Austria - martin.schoenhart@boku.ac.at

Abstract: *Local food systems (LFS) are considered as alternative approach to the mainstream food system (MFS) in industrialized countries. Their main features are proximity and a regional limitation of the food supply chain. LFS are advocated by different stakeholders, among them scientists, for their expected potential to achieve sustainable development. With respect to the food system, the normative concept of sustainability consists of a social, environmental, economic, and a personal well-being dimension. These dimensions are used as analytical framework to critically discuss and summarize frequent arguments in favour of LFS and to confront them with contradicting evidence from empirical case studies and own considerations. Most of the expected effects, e.g. reduced environmental burden from food distribution, turn out to be bi-directional and depend on the specific circumstances of the LFS. For a sustainable implementation, trade-offs have to be made. For example, the direction of many effects in LFS is correlated to the size of the region. A smaller region reduces the distance between the stages in the food supply chain and increases the potential for many desired environmental and social effects depending on proximity. On the other side, it may increase environmental and economic burdens through less efficient agricultural production, food processing, and distribution. Several path-dependencies may hamper a successful implementation as well. For example, current modern life-styles, expressed by the demand for highly processed convenience products, functional food, and products out of season, hardly fit to a LFS. It becomes clear that scientific evaluation is crucial for sound policy guidance. Until now, this is done rather fragmented and mainly ex-post to implementation. Therefore, an orientation towards holistic ex-ante assessments is suggested, although this may be accompanied by serious challenges for research design.*

Keywords*: local food system; sustainable development; scientific evaluation*

Introduction

Patterns of food consumption and production have changed a lot in industrialized countries during the last decades. Rationalization and specialization in agricultural production and food processing, concentration of retailers, highly elaborated distribution systems, and longer geographic distances from farm to fork are some examples describing a food supply chain of today. Moreover, the share of out-of-home consumption and the demand for convenience products are constantly growing. Efficiency gains in the food supply chain and intensified trade relations have brought about an unprecedented welfare for consumers. The share of household expenditures spent on food has been constantly decreasing by an increasing availability and selection of food products. However, economic progress was accompanied by increasing energy and material inputs into the food supply chain, partial degradation of natural habitats and socio-economic disruptions of some rural areas. Loss of cultural identity and traditional knowledge, and distrust into an ever expanding and increasingly complex food system are further effects. There is also an increasing unease about the worldwide socio-economic and environmental consequences of the modern food system.

Different pathways towards more sustainable patterns of food production and consumption are proposed. Local food systems (LFS) are an alternative approach to the mainstream food system (MFS). They are advocated for diverse reasons by different stakeholders like politicians, regional planers, and farmers, despite their contentious effects. Consumers are increasingly interested in different types of LFS since the 1990's (Mathijs, et al., 2006). The scientific community has different views on the capacity of LFS to promote sustainable development. We can roughly categorize three groups. Some scientists, mainly from environmental and social science disciplines, seem to unequivocally support the idea of LFS by focussing on their advantages and necessary circumstances for successful implementation (Pretty, 2000; Halweil, 2002). They argue from what Born and Purcell

(2006) call the local trap by regarding the local scale as being superior to others in general. Mainly economists challenge the idea of LFS by pointing out the lack of scientific evidence for environmental benefits and the likely losses on economic efficiency (Pfister, 1998; Schmitz, 2000). It should have been investigated, if there does exist something like a *global trap*, where scientists reject the local scale as such, because of a narrow perspective obtained from selected case studies. A third group seems to be less polarized but still critical to the idea of LFS by pointing out that the terms "local" and "global" are socially constructed (Hinrichs, 2003, Ermann, 2005). They challenge an "unreflexive localism" (DuPuis and Goodman, 2005) and claim that both positive and negative overall effects are possible in general and, thus, each single case needs to be assessed in order to derive scientific judgements (Born and Purcell, 2006; Weiss, 2007). Such holistic and quantitative assessments are still rare and mostly ex-post to the implementation of LFS.

In our study, we try to approach the issue of LFS from this third perspective with a particular focus on an ex-ante evaluation. The work on the research design of a PhD-thesis about the interactions of food consumption, landscapes, and climate change indicated major challenges for scientific ex-ante evaluations of socio-economic and environmental LFS effects. Indeed, it brought about substantiated doubts on the feasibility and practicability of such ex-ante evaluations.

After a short definition of LFS, this paper focuses on LFS effects that are frequently argued by different stakeholders and confronts them with critical evidence from scientific literature. The analysis is based on a literature review and conducted from a meta-level. We outline differences between expectations of stakeholders and possible actual effects from empirical evidence of ex-post case study results. The last chapter discusses these challenges and doubts, which scientists might be confronted with if they try to do an ex-ante evaluation of LFS for a particular region.

Results and Discussion

Definition of LFS

There is no single definition of LFS in the scientific literature, but in most cases, spatial distances and personal relationships between the various stages of the food supply chain as well as restrictions to a geographic region are the relevant issues. For the purpose of this analysis, we follow a narrow definition, in which all activities of the food supply chain – from agricultural food production to consumption – are located within the same geographic region. In order to give substance to this concept, agricultural inputs of labor and raw materials like feed for animal production are included. Regional borders need not to be strictly defined, may range from the municipal to the country level or even beyond, and can vary for different types of products, but the geographic extension is limited by the need for enabled personal relationships between producers and consumers. What is critical is the information embedded with the product (Marsden et al., 2000). Examples for distribution modes of LFS are farmers markets, box schemes, or community supported agriculture. LFS must not be confused with products of designated origin, where the location of production is communicated to consumers, who can be located in any other region of the world.

A stylized local and a mainstream food system are shown in Figure 1. Major differences from this simplistic perspective are the regional limitation for LFS, the local sourcing of agricultural raw material inputs, and the likely reduced number of intermediary stages in the food supply chain between agricultural food production and consumption. The dichotomy between LFS and MFS does not exclude the latter to maintain some steps of the food supply chain in the same region. The dotted arrows indicate that a minimum level of interregional trade is necessary in order to supply other regions with surplus production and to provide the LFS with products that can not be locally produced such as for example coffee or salt water fish in any Austrian region or wine in higher altitudes.

Although diets and plant species for food production have always been changing as a consequence of human migration (Braudel, 1985; Visser, 1998), LFS were the standard system of food supply for the majority of people until the 20th century. Today, LFS only play a minor role in industrialized countries. This switch has been made possible for instance by innovations in logistic systems and food processing. Nevertheless, 20% of the Austrian population in 2005 stated to buy food from farmers directly at least once a week. In 2004, 36% of all farmers maintained direct marketing activities while about 12% of all Austrian farmers earned more than 20% of their income with direct marketing (BMLFUW, 2006). Not only quantity, but quality has changed too. LFS have delivered mainly bulk

goods in the past. Today, it seems that they have become part of the prime market where attributes of quality, novelty, and speciality are far more important for consumers.

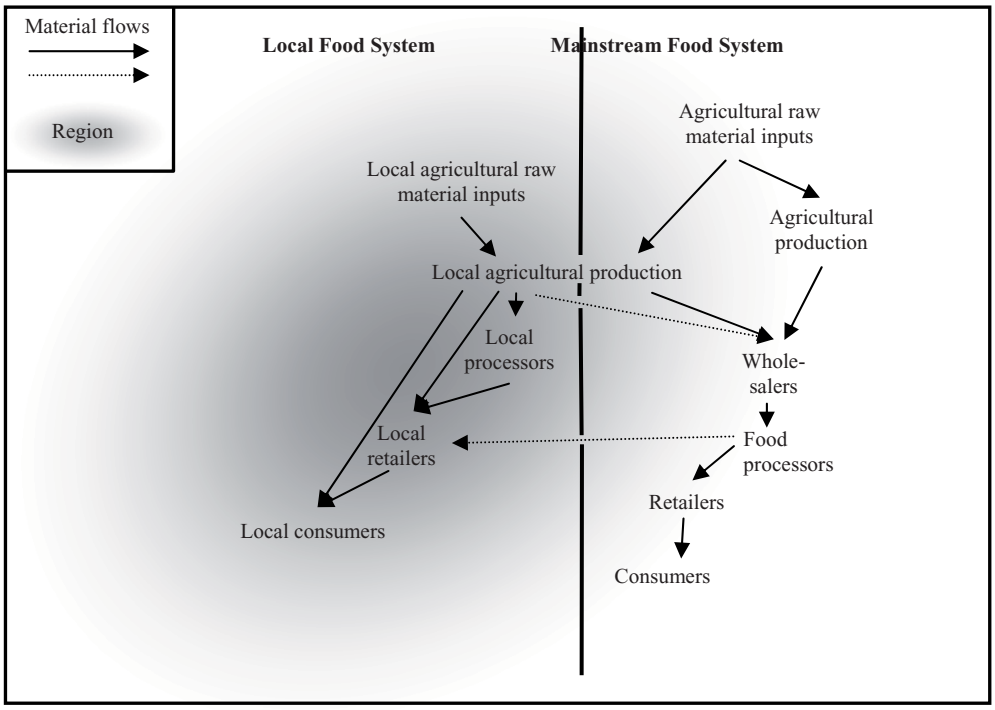

Figure 1. Local and mainstream food system (Source: Own construction)

Expectations of stakeholders on LFS and their possible effects

Arguments in favour of LFS are frequently related to the normative framework of sustainable development. With respect to the food system, this framework can be considered as a discursive bargaining process of all relevant stakeholders that aims to achieve social and intergenerational justice (Penker and Payer, 2005). As analytical concept, sustainability generally consists of ecological, economic, and social dimensions and is applied from a macro-perspective that considers economy, nature, and the society as a whole rather than its single dimensions. Hofer and Stalder (2000) suggest a fourth dimension of sustainability – personal health – which is especially important for food consumption activities, but difficult to assign to any of the other three dimensions. In our analysis, we extend personal health to the broader concept of "personal well-being" in order to take into account the importance of individual perceptions, judgements, and consequences of food consumption activities. From our perspective, the personal dimension of food consumption disserves a separate dimension although it is often included in the social dimension. Table 1 provides an overview on exemplary effects of LFS frequently expected by stakeholders and also mentioned in the scientific literature (for exemplary sources see the following section). They are grouped with respect to the four-dimensional sustainability framework.

Table 1. Frequently expected effects of LFS as observed in ex-post evaluations of case studies

Dimension of sustainability	Expectations
Ecological	Reducing environmental effects of transportation like emissions of air pollutants
	Reducing specialization and intensification in agriculture through a more diverse local land use
	Conserving traditional agricultural landscapes
	Fostering envrionmentally friendly production methods (organic production, protection of local biodiversity, reduced chemical inputs)
Economic	Increasing the regional added value
	Reducing prices of seasonal products
	Creating employment opportunities
	Raising the income for farmers and food manufacturers
	Reducing local dependencies on external market forces and reducing market power of processing and distribution businesses
Social	Keeping agricultural production and small manufacturing enterprises in the region
	Conserving traditional production techniques and consumption patterns (cultural identity)
	Creating small and manageable structures
	Increasing security of food supply
	Increasing awareness about environmental and social effects of consumption (embeddedness-effect)
	Raising social justice locally and internationally
	Increasing community power and personal relationships
Personal well-being	Providing food for better health and nutrition
	Providing fresher and better tasting food as well as specialities
	Increasing satisfaction of farmers (and processors) with their jobs

Source: Own compilation

Effects on the environment

Reductions in product shipments through shorter distances between the stages in the food supply chain are among the most important arguments in supporting LFS. As an assumed consequence, environmentally harmful effects of transportation like emissions of green-house-gases and other air pollutants may be reduced. While the first assumption on reduced distances for product shipments may be valid for most cases, the second is not necessarily true. Many environmental effects from transportation, especially emissions from combustion engines, mainly depend on two variables, the distance and the effects of the transportation mode per distance unit. Transportation emissions in LFS are at risk of being more environmentally harmful than in MFS if shorter distances are offset by inefficient means of transportation and a low utilization of loading capacity. This is the case for important distribution schemes in LFS at least in Austria (BMLFUW, 2006) where farmers bring their produce to the market by private cars or small trucks and consumers drive to the market or directly to the farm by car additionally to their daily shopping trips. Van Hauwermeiren, et al. (2007) compared LFS to MFS for a selected number of products and have proved that transportation in LFS is in general more energy consuming per unit of product but in the same order of magnitude. They claim however, that their results are sensitive to the assumptions and do not take into account effects outside the system boundaries. Large variations are possible between different LFS. It becomes obvious that efficient distribution systems like those of retailers are essential for a successful implementation. Demmeler and Heißenhuber (2003) have shown that products of LFS, which are distributed via a supermarket chain can reduce environmental effects of food transportation by about two third on average in comparison to MFS. However, several framework conditions may hamper such alliances between retailers and local food suppliers. Important among others are the higher transaction costs for retailers through the interaction with many small and local suppliers and the inapplicability of small local structures with distribution systems that source globally.

Beside food distribution, other stages in the food system - agricultural production, storage, processing, packaging, preparation, and disposal - have effects on the environment as well. It is not possible to derive general rules about the relative importance of the different stages in the food system, but environmental effects from transportation may even be of minor importance (Jungbluth, 2000). What is certainly important with respect to food production and the environment is agricultural management. LFS are often conflated with organic production (Born and Purcell, 2006), but a differentiation is necessary again. The gradual shift from the mainstream towards a local food system may indeed have some positive effects on land use, mainly through the likely need for a more diverse range of goods locally produced and reduced imports of input products like feed from ecologically sensitive parts of the world. The higher demand for more diverse local products may also help to maintain traditional agricultural landscapes. But on the other side there is no reason to assume that ecological behaviour of land users will change in general. In contrast, there may be even higher pressures on the environment through the lack of available regional land resources and increasing production intensities in order to meat local demands. A case study for Great Britain showed that regional land resources are not sufficient to maintain food consumption based on current diets (Cowell and Parkinson, 2003). Meat and dairy production often depend on imported feed and replacement with regional resources will be difficult to achieve in some regions. In order to provide certain goods, for example various vegetables in temperate climates, energy demanding production techniques like heated green houses may even be necessary. Apart from agriculture, food processing and commercial storage are further sources of environmental pollution and LFS can hardly be assessed without taking into account all differences in the food supply chain. Several studies investigated scale effects and show that in many cases larger production units can offset negative effects from raw material sourcing over larger distances through environmentally more efficient processing (Höper, et al., 2000; Koebler, 2001; Schmidtlein, et al., 2002; Schlich and Fleissner, 2005). Reasons are more frequent technological re-investments, higher pay-offs for environmentally friendly production techniques and resource management, and lower per-unit effects of large scale production and processing.

Economic effects

Economies of scale are one of the most important arguments against LFS, and their rational is similar to that of environmental effects. Smaller units of production are often less efficient and regional trade restrictions prevent from making use of comparative advantages. Regional exporters and importers may loose market shares and labor demand, which may also be disadvantageous for economic development. As a consequence, higher overall costs in LFS are likely. However, there may be regional economic benefits of LFS as well. The higher regional added value and higher incomes by farmers and local processors can foster economic development and may offer new employment opportunities. Some intermediary stages in the food system are not needed and reduce marketing costs. Mathijs, et al. (2006) for example compared prices of six products. Their results show that all product prices for farmers have been higher in the LFS than in the MFS and five out of six have been lower for consumers. It has to be mentioned that this analysis did not include highly processed food, but fresh vegetables, fruits, and beef. For a judgment on local incomes, production costs would have to be taken into account as well. Similar to the ecological effects, this positive price situation may change with increasing degrees of processing. A further effect of LFS relates to economic dependencies. Direct relationships between private consumers and local producers may reduce dependencies on only a few large retailers and wholesalers, but they may create new ones instead, for example for consumers through reduced competition among the suppliers, or in community supported agriculture for farmers if they economically depend on only a few customers.

Effects on the social system

Social effects of LFS may be the least controversial, but - or maybe because - they are difficult to measure. Some of them are related to shorter spatial and organizational distances in the food system. This proximity is expected to create the potential for personal relationships between producers and consumers (Sage, 2003) and as a consequence should raise the awareness about social, economic, and environmental external effects of food consumption by tightening feedback loops (Sundkvist, et al., 2005). It is frequently assumed that consumers, who would rely on local resources and have the chance to directly recognize the outcomes of their own consumption decisions, may switch to a more sustainable behaviour or utilize consumption activities as a mean to pursue a broader range of goals. An example of the latter would be if one buys local products also for maintaining the traditional landscape. Many of these ideas can be summarized by the concept of embeddedness, which is not

limited to LFS only (Penker, 2006). LFS indeed decrease the distance between producers and consumers, but it is less clear if this will also strengthen feedback loops - an information bias in both directions will persist anyway - and will lead to a more sustainable behaviour of consumers as well as producers. Instead, large organizations with their established brands and certificates and policy measures like environmental payments may be more efficient in guaranteeing socially preferred production techniques than face to face contact. Social justice and community power are complex multi-dimensional concepts and there are many questions about the effects of LFS left open. While income shifts to farmers and small processors may be socially accepted and some forms of LFS like community supported agriculture can probably prepare the ground for democratization e.g. by commonly deciding on local resource choices (Lamine, 2005), inequalities may even increase if economic gains are unequally distributed (Born and Purcell, 2006). “Local” therefore is not just by itself (DuPuis and Goodman, 2005).

Other expected social effects of LFS are related to the regional preservation of agricultural production, food manufacturing, and traditional techniques of production and consumption for cultural reasons and food security. Substantially diverse food production and consumption patterns will indeed be difficult to maintain in a globalized food system although cultural peculiarities are persistent and do still exist until today (Brunner, 2005). An indication for such approaching patterns is that only a few grain species are used for food products and feed today instead of the many traditional local plant and animal varieties and species used in the past. Higher prices for producers in LFS will very likely help to maintain regional production, but structural change may still be a social problem. Certainty in agricultural incomes may raise the security of food supply. However, the reliance on regional resources may even reduce food security by increasing the vulnerability for large scale natural disasters like droughts or floods. Another issue of food security is related to the dependence of agriculture on energy, seasonal labour, and capital, which are often imported into the region. The concept of LFS would have to be broadened to local supply of these production factors at least for agriculture in order to improve security on food supply substantially.

Effects on personal well-being

Products from LFS are frequently expected to provide a number of benefits to personal well-being. LFS are assumed to be healthier, more nutritious, better in taste and fresher than food products from MFS (Hinrichs, 2003; Ilbery and Maye, 2005). Speciality products instead of globally uniform goods are seen as advantage of LFS. Some of these arguments are reasonable because fresh and less processed food, an essential component of LFS, is considered to be healthier and better tasting. Improved animal well-being through reduced livestock transport can have influences on product quality as well. Furthermore, potentially shorter spatial distances and time periods from harvest to consumption for fresh vegetables and fruits may permit to crop perishable varieties that are inappropriate for industrial production, but nutritious and tasty. However, the cited food attributes are not necessarily inherent in LFS. Taste, freshness, and nutrient contents partly depend also on storage and processing techniques, where MFS have technological advantages. Particularly for those products not consumed during the harvest season, shorter spatial distances are not equal to freshness, which depends more on duration and storage between harvest and food intake (Born and Purcell, 2006). A sometimes critically perceived use of artificial ingredients may be out-weighed by advanced production systems that can guarantee high standards for food security and traceability. LFS may hardly provide such a broad range of different products than MFS and it has to be proved if comparably healthy diets are possible with LFS as well. This is especially true for functional food and, depending on the regional climate, for the year-round supply of fresh vegetables and fruits. LFS may bring back “novelty and the appreciation of seasonality” (Colquhoun and Lyon, 2001, 93) for some regional residents, but for others, it may be an undesirable restriction of consumer’s choice and, hence, may be perceived as reducing quality of life. As a solution, exchange of excess food products between different LFS is suggested (Demmeler and Heißenhuber, 2003). However, the more such products from outside a region are incorporated into a LFS, the lower are other mainly environmental and economic positive effects. If there are no significant adaptations in regional diets, costs for the overall food basket can expected to be higher with LFS according to the above discussion on economic effects. This may create social disruptions in the region by changing welfare distribution and reduces personal well-being.

Not only the products of LFS, but the system itself is seen as a mean to improve personal satisfaction. This may be equally important for producers for instance through increased satisfaction with their jobs or higher incomes, and for consumers for example by raising the shopping experience (Hinrichs, 2000; Sage, 2003). As Mathijs, et al. (2006) pointed out, the amount of appreciation for their jobs do not

primarily depend on the marketing system, but on the farmers themselves. While for some, the personal relationship to their costumers may increase well-being, for others it may be a burden.

Framework conditions, path dependencies and trade-offs affecting LFS

A number of challenges towards sustainable LFS have been raised above. The effects are far from being obvious and transparent. Trade-offs and framework conditions need to be made to design sustainable LFS. For example, the direction of many effects in LFS is correlated to the size of the region. A smaller region reduces the distance between the stages in the food supply chain and raises the potential for many desired environmental and social effects depending on proximity. On the other side, it may increase environmental and economic burdens through less efficient agricultural production, food processing, and distribution and therefore refrain from economies of scale and what Schlich and Fleissner (2005) call “ecologies of scale”. Another trade-off is related to the distribution of products in LFS. Any established alliance with retailers can lower negative effects on the environment, but on the other side may also reduce the added value for local farmers and food processors again. In order to reduce many of these negative environmental and economic effects of LFS, a move towards local food consumption would have to be accompanied by an overall shift in diets and consumption patterns like a reduction of meat and dairy products consumption and increasing demand for fresh and seasonal food mainly stored and processed at home.

Several social developments in industrialized countries have created “cultural” path dependencies, which may decrease the likelihood of such changes today and in the future. Increasing incomes, higher female employment rates, and the emergence of a leisure society have reduced the available time for preparation of fresh and low processed food in private households and have made modern consumption patterns affordable. The use of highly processed convenience products is increasing even in restaurants and canteens for reasons of time efficiency. These trends are accompanied by a rising share of functional food in western diets. A further trend is related to the increasing diversity of diets. “Exotic” products and the desire for specialities and year-round supply of fresh vegetables and fruits may challenge the idea of seasonality, which is inherent in the LFS concept. It has to be mentioned that counter movements to these trends are emerging, but it is unclear yet how these activities will develop in the future and if they can attract more people. Such a high share of a local population demanding products from LFS is required, however, in order to allow an efficient and therefore more likely sustainable implementation.

Regional agricultural production, food processing, and distribution facilities as well as know-how for production and marketing are crucial for a successful implementation of LFS. Diminishing local infrastructure for production and their replacement by global production and distribution schemes pose a serious challenge on the implementation of LFS and may create a further “organizational” path dependency. Unilateral technological developments for agricultural production and food processing like machinery or plant varieties have been oriented mainly towards large scale and capital intensive production, but for LFS, so-called “medium technologies” are more important. Once, local facilities, adapted animal and plant species, and know-how for agricultural production, food processing and distribution are gone, reinvestments are much more difficult. The decline of independent grocers and food processors and the rising power of ever larger multinational retailers may create a business environment that further reduces the likelihood for a successful and sustainable implementation of a LFS in the future.

A serious challenge to LFS from the political agenda may have emerged through the chosen paths towards an international and globalized economy. The underlying intentions of the Single European Market and international trade agreements are fundamentally against the idea of the re-localization of food production and consumption. Within these agreements and political agendas, different answers for questions on the environmental and social quality of production processes and the multifunctional character of agriculture are proposed and discussed. Essential supportive policies for LFS will have to take account of EU and WTO realities.

Challenges on LFS research

The discussion on effects and challenges to LFS shows the importance of scientific assessments for sound policy guidance and public information towards a more sustainable development. The various directions for many effects of LFS underline the need for investigations of each single case. Only interdisciplinary holistic approaches that take into account social, environmental and economic influences will provide meaningful results for evaluation. Furthermore, research needs to be extended

to the human dimension of personal well-being taking into account issues of health, social relationships, and trust in food quality, and should take into account major global changes like demographic and life-style transitions, climate change, and issues of energy supply, which influence local resource choices and food consumption patterns now and in the future.

Until now, ex-post evaluations of single products and their isolated effects have been the major methodological approach. However, ex-ante assessments are equally important for policy advice and necessary due to the broad range of possible outcomes and the lack for standardized rules. Contrary to ex-post evaluations, they can analyse effects of LFS not yet implemented, i.e. also hypothetical, more drastic re-orientations of the food system towards localisation of food production and consumption. We want to discuss some challenges related to this kind of evaluation for a particular region. As Born and Purcell (2006) point out, research on LFS should be value-free with respect to the issue of scale, but it should also take into account those mainly social aspects, which are difficult to measure and to compare with environmental or economic effects. A starting point for research should be the question about the explicit and implicit goals of the LFS. As we have already seen, there may be a large diversity of social, environmental, and economic goals and some of them may be even conflicting. As LFS are substitutes for other systems, any evaluation should compare those different systems. For example, if effects of milk processing under varying processing capacities are investigated, one has also to adapt distribution schemes accordingly. A comparison of transportation effects for unprocessed fruits or vegetables can be misleading if agricultural production under regionally different production conditions is not considered. Besides LFS, there are probably further measures that could be more appropriate and these need to be assessed as well. For example, maintenance of traditional agricultural landscapes and environmentally friendly production methods may be reached more efficiently by subsidies, which probably creates less unwanted external effects. In any case, one should always raise the question, whether the preferred alternative systems will be accepted by consumers and the public and how they can be realized in practice (Brunner, 2005). Challenging to the evaluation of both the current and the hypothetic local food system is data availability. Consequently, one has to know current regional product flows, production costs and prices. Many assumptions about likely consumption patterns, future regional output prices and production costs are necessary as well. While some regions are already equipped with regional food processing, storage, and distribution facilities and, hence, might be able to introduce LFS more easily, others may lack such infrastructure. It has to be proved how such a situation can be implemented into the research design. The same is true for outflows and inflows of materials and energy. According to Figure 1, a second food system will be necessary in any case in order to supply regions with food shortages and it has to be considered, how and where processing, storage and distribution of these goods will be maintained.

In any case, a detailed specification of the system boundaries is necessary. This includes the choice on the geographic boundaries of the region, the investigated effects and food products, and the stages in the food supply chain. Any regional restriction will be somewhat artificial and has to take into account the trade-offs related to its size. A further challenge to modelling approaches comes from the fact that regional specifications need not to be equal for all investigated products in a LFS. But even the regional system boundaries make an assessment of external effects necessary. Any large-scale move from MFS to LFS can have far-reaching effects for instance on food exporting countries where it may hamper economic development.

A further important issue is related to the unit of measurement. In most cases and as a consequence of life cycle assessments (LCA), comparisons are based on product units. Apart from many other methodological challenges related to LCA (Hertwich, 2005), the number of units traded in the systems to be compared may have considerable influences on the results. This again raises the issue on the importance of the assumed rates of acceptance of local residents for both local as well as main stream food systems.

Conclusions

Many case studies and critical assessments have already shown the ambiguous character of LFS and the need for careful statements on its benefits and costs. But still, many stakeholders, among them scientists, seem to be unreserved optimistic about the potential of LFS to foster sustainable development in industrialized countries. With our paper, we want to contribute to the critical discussion by summarizing frequent arguments in favour of LFS and confronting them with contradicting evidence and arguments. Most of these effects are bi-directional and depend on the specific circumstances of

any single case as the turn to local food may cover many different forms of production and consumption (Winter, 2003). Trade-offs between various goals and path dependencies challenge any successful implementation. The complexity of food systems and their effects on the society, environment, economy, and personal well-being, make careful assessments difficult, but all the more necessary. Until now, case studies have mainly been fragmented and ex-post, which limits the relevance and possibility for generalizations of their results and, thus, the applicability for policy advice. Furthermore, they cannot analyse the effects of hypothetical, new or more extended forms of LFS. A more holistic ex-post evaluation may alleviate some of the current shortcomings, but bring along a number of other challenges for data availability, modelling, and definition of system boundaries. We suggest that research should not start by asking whether LFS are good or bad, but by asking what are the problems to be solved, what are possible solutions, what forms of LFS can contribute best to problem solution and are there alternatives that would fit better to improve the situation. For example, a shift in diets towards less meat and the consumption of organically produced fresh and seasonal products may have much bigger effects on the sustainability of the food system than the implementation of LFS. From such a holistic perspective, a total replacement of the main stream by a local food system seems unrealistic. More likely and promising is a dual system of both local and global production (Bätzig and Ermann, 2001), where globally sourced products of the food basket are replaced by seasonal food from sustainable regional production as far as possible. Research therefore should focus more on the links and synergies between both systems instead of isolated analysis.

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