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Enhancing the Design and Management of a Local Organic Food Supply Chain with Soft Systems Methodology

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Abstract

Supply chain partners for local organic food face uncertainties such as poor collaboration and communication that cannot be reduced through the application of traditional supply chain design and management techniques. Such techniques are known to improve supply chain coordination, but they do not adequately consider major aspects of local organic food supply chains such as ethics, sustainability and human values. Supply chain design and management approaches suitable to small-scale, local organic food enterprises are lacking and need to be developed.

The aim of this paper is to suggest Soft Systems Methodology (SSM) as a new and suitable approach to design and manage local organic food supply chains. We illustrate how SSM can be used to reduce uncertainties within local organic food supply chains based on a German case. This illustration serves to identify the benefits of using SSM, compared with ad hoc, pragmatic and less structured approaches. The major benefits are of thought, intervention and change, as well as action-oriented, meaningful and participatory decision making.

Keywords: supply chain management, supply chain design, organic food, Soft Systems Methodology

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Introduction

Designing and managing local organic food supply chains (LOFSCs) is complex, and it faces socially bound uncertainties such as poor collaboration, communication and information sharing (Kottila et al. 2005; Strauch and Schaer 2005, 21; Stolze et al. 2007; Hindborg 2008, 347; Kledal and Meldgaard 2008, 309-315). Such complexity cannot be reduced through quantitative supply chain design and management techniques. Quantitative techniques have been found useful to improve supply chain coordination and efficiency, but they are inadequate for considering key aspects of LOFSCs such as ethics, sustainability and human values (Milestad et al. 2010) that influence decision making and supply chain activities. LOFSCs are mainly composed of small-scale enterprises (Milestad et al. 2010) that face limitations to implementing complex mathematical models and sophisticated software used in quantitative supply chain design and management (Dutta and Evrard 1999; OECD 2000; Celuch et al. 2007; Ahumada and Villalobos 2009). Viable and well established approaches to reduce the inherent uncertainty, design and manage LOFSCs are lacking and need to be developed (Marsden et al. 2000; Kledal and Meldgaard 2008, 309-315).

In practice, LOFSC partners mainly manage their relationships *ad hoc*, through personal communication, and reach agreement through hand-shaking (Marsden et al. 2000; Morgan and Murdoch 2000; Sage 2003; Stevenson 2009, 7). Organized and facilitated approaches such as workshops and information meetings, however, have been found to be more successful, especially in a long-term perspective (Marsden et al. 2000; Strauch and Schaer 2005, 4-28; Hindborg 2008, 345-350). Some successful implementations of facilitated approaches have been documented, but there is still a need to develop and explore systemic, structured, flexible, and practically 'softer' approaches to design and manage LOFSCs.

The objective of this paper is to suggest Soft Systems Methodology (SSM) (Checkland 1981; Checkland and Scholes 1990) as a new approach to tackle uncertainties within, and to design and manage LOFSCs. SSM is useful in facilitating common understanding and sense making of unstructured problem situations, as well as achieving agreement on actions to alleviate them (Checkland and Scholes 1990; Rosenhead and Mingers 2001). This understanding, sense making and agreement may help LOFSC partners reduce uncertainties, support supply chain coordination, and enhance supply chain efficiency. As a well-established problem structuring method (PSM) (Rosenhead 1996), SSM is a participatory approach to intervene in problem situations, and enhance collaboration, communication and information sharing within multi-organizational groups (Huxham 1991; White and Taket 1997; Gregory and Midgley 2000; Taket and White 2000; Franco 2008, 2009). Besides, SSM enables problem solving through dialogue and qualitative methods, and it explicitly considers aspects such as ethics, sustainability, and human values (Wilson and Morren 1990, 73-106; Kunsch et al. 2009; Mingers 2011). This paper illustrates and discusses how SSM may be used to tackle problem situations within LOFSCs. The illustration and discussion is based on a case within the German organic cereal sector (Bahrdt et al. 2002) and serves to highlight the benefits of using SSM compared with less 'systemic' and structured approaches (e.g. expert interviews, telephone surveys and workshops that are not based on the application of a specific intervention methodology). We use the information provided in the case report to illustrate the stages of SSM. Drawing on SSM literature we show how the process of

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SSM could have been applied within the case to better understand and structure the problem situation, support the participants in making decisions and reaching agreement on action plans.

A new contribution to the literature is achieved because SSM is here presented as a new problem solving approach which is useful to the local organic food sector. Within this paper, we provide a guideline for LOFSC partners to intervene and act in problem situations. This guideline shows how SSM is applied in practice, answers why it may be useful and emphasises the benefits of using it.

Local Organic Food Production

In the developed world, since the Second World War, food has mainly been produced through conventional, industrialized and resource intensive practices, which has caused environmental degradation, resource depletion, health scares and consumer anxiety concerning food safety. Farmers, consumers, policy makers and researchers recognized the need for environmental and human protection, and thus started to support alternative food systems such as organic agriculture (Sage 2003; King 2008). The International Federation of Organic Agriculture Movement (IFOAM 2005) defines organic agriculture as, "a production system that sustains the health of soils, ecosystems and people...Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved".

The organic area in the EU has been estimated to amount to 7.6 million ha with an increase by 7.4% per year (from 2000 to 2008) and 197.000 holdings (in 2008). The household expenses for organic food correspond to 1.9% of total food expenses implying difficulties for producers to sell their products and a consumers' limited purchasing power. Although, the sales of organic food in Italy, Germany and France have been increasing between 2000 and 2009 (average increase in Italy of 8.7%, in Germany of 14%, and France of 18.1%) (European Commission 2010, 1, 40-42).

Compared to conventional produce, organic food has to be produced, processed and marketed according to strict regulations and national legislation and it is often produced and sold within local food supply chains (Milestad et al. 2010). LOFSCs are mainly composed of small-scale enterprises that aim to maintain short distances between each other and to end-consumers. Enterprises are diverse and they focus on holistic production practices and often sell their products through alternative food purchasing venues (e.g. farmers' markets and box schemes). Supply chain partners and end-consumers are committed to sustainable, ethical food production, distribution and consumption, whilst they appreciate trust, respect and values (Hinrichs 2000; Marsden et al. 2000; Sage 2003; King 2008; Björklund et al. 2009).

Local Organic Food Supply Chains – Problem Situation

In general, agri-food supply chains are more complex to design and manage than most other supply chains (Ahumada and Villalobos 2009). Supply chain partners, for example may face uncertainties that mainly result from a lack of information and knowledge about markets; isolation of supply chain partners; different perceptions, attitudes, values and motivation among supply chain

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partners; and the limited size of enterprises (Bahrdt et al. 2002; Kottila et al. 2005; Milestad et al. 2010). These uncertainties need to be controlled and reduced in order to design and manage supply chains, ensure supply chain coordination and achieve competitiveness and customer service (Stadtler 2005). In addition, reviewing the LOFSC-related literature, the following types of uncertainties are identified:

- Difficulty in choosing the right supply chain partners (Kledal and Meldgaard 2008, 309-315);
- Difficulty in finding skilled supply chain partners (who have specific knowledge concerning organic food production and processing and management and economics) (Middendorf 2007; Kledal and Meldgaard 2008, 309-315);
- Difficulty in establishing contacts and dialogue with buyers (Hindborg 2008, 347);
- Inefficient and a lack of information sharing between supply chain partners (Kottila et al. 2005; Strauch and Schaer 2005, 21; Stolze et al. 2007);
- Difficulty in communicating differences between organic and conventional products to end-consumers (Kledal and Meldgaard 2008, 309-315);
- A lack of agreement among supply chain partners (Stolze et al. 2007; Kledal and Meldgaard 2008, 309-315; Naspetti et al. 2009);
- A lack of cooperation among suppliers causing shifts in raw-material quantities and quality (Kledal and Meldgaard 2008, 309-315);
- Barriers to accessing supermarkets for small-scale enterprises (Bahrdt et al. 2002, 28).

Such types of uncertainties are typically found in unstructured, complex problem situations (Rosenhead and Mingers 2001), as well as multi-organizational and collaborative groups (Gray 1989; Huxham and Vangen 2004). Stakeholders facing such uncertainties need to collaboratively engage in dialogue in order to understand, make sense of and structure the problem situation. Dialogue facilitates negotiation, accommodation of diverging interests and shared agreement on feasible actions to reduce the uncertainties (Rosenhead 1996; Franco 2009).

Compared to conventional producers, LOFSC partners have different needs concerning supply chain design and management (Marsden et al. 2000; Morgan and Murdoch 2000). The local distribution of organic food, for example through alternative food purchasing venues, is based on supply chain relationships which are different from conventional food distribution which occurs through global, larger companies. Local organic food suppliers, furthermore, require flexibility in supply chain activities as they may be distributing food through different channels ranging from farmer stands to restaurants and supermarkets. The presence of different channels opens up the opportunity to approach a broader range of customers and find a suitable niche for organic products. This, however, requires food suppliers to adapt to the customers' specific conditions: price setting by supermarkets (Milestad et al. 2010) and food demand in schools, kindergartens and restaurants differing from the seasonality of local produce are some of the challenges.

The next section defines supply chain design and management and reviews how uncertainties are traditionally controlled and reduced.

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Supply Chain Design and Management

Supply chains are networks of organisations that are connected with each other with the aim of processing and selling products to end-consumers. Supply chains include suppliers, producers, customers, and end-consumers, but also transporters, warehouses, and retailers, depending on the specific supply chain configuration. Agri-food supply chains are networks of organisations that produce and sell fresh or processed products from vegetables, crops or animals (van der Vorst et al. 2007). In order to ensure materials, information and financial flows between supply chain partners, supply chains must be dynamic and flexible, built on cooperation, coordination, control and trust (van der Vorst et al. 2007; Naspetti et al. 2009).

Supply chain design (SCD) is a process to build supply chains. It consists of: (a) the choice of supply chain partners; (b) the identification of customer segments; (c) the location of production and distribution facilities; and (d) the identification of facility capacity and transportation means (Stadtler 2005). Stadtler (2005, 576), moreover, presents SCD as the basis for supply chain management (SCM), which is "…the task of integrating al units along a supply chain and coordinating materials, information and financial flows in order to fulfil (ultimate) customer demands with the aim of improving competitiveness of the supply chain as a whole". Supply chain partners achieve competitiveness and customer service through enacting supply chain activities such as managing relationships, defining supply chain leadership and advanced planning (Stadtler 2005).

Quantitative techniques have been found useful for supply chain design and management, especially to control and reduce uncertainties and to make optimal decisions (examples in: Beamon 1998; Reiner and Trcka 2004; Apaiah and Hendrix 2005; Santoso et al. 2005; Wang and Shu 2007; Thanh et al. 2008; Ahumada and Villalobos 2009; Hammami et al. 2009; Schütz et al. 2009). Supply chain contracts (Cachon 2003; Simchi-Levi et al. 2008, 125-138) and inventory management (Axsäter 2003; Graves and Willems 2003) have been used to manage relationships between supply chain partners and to coordinate materials, information and financial flows. Supply chain management through supply chain contracts may be optimized through quantitative analysis of possible types of contracts that match specific supply chain configurations. Quantitative analysis identifies supply chain partner´s profit and the global profit of supply chains. Therefore it enables the implementation of optimal contracts to enhance supply chain coordination (Cachon 2003, 5). Supply chain management and decision making through inventory management, similarly, rely on quantitative analysis of different supply chain configurations (Axsäter 2003).

These techniques, however, do not adequately consider LOFSC partners´ capabilities or needs. The application of quantitative techniques to control and reduce uncertainties within LOFSCs is limited. Quantitative supply chain design and management techniques require the application of complex mathematical models and advanced software. Not only are large amounts of precise data necessary that are difficult to collect and tabulate (Simchi-Levi et al. 2008, 90; 130-131), but also financial assets, sophisticated strategies, specific skills and knowledge. Such resources are lacking within small-scale enterprises, which limits the introduction of complex mathematical models and advanced software (Dutta and Evrard 1999; OECD 2000; Celuch et al. 2007). Quantitative techniques, furthermore, do not include variables which address major uncertainties within LOFSCs such as a lack of agreement, collaboration, communication and information sharing.

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Besides, decision making to reduce uncertainties and to design and manage LOFSCs also depends on ethical, moral and sustainability aspects that are not adequately considered by quantitative techniques.

Considering the nature of LOFSCs, new supply chain design and management approaches need to address: (i) the development and support of relationships between supply chain partners; (ii) the consideration of financial and intellectual capabilities; (iii) a focus on ethical, moral, and sustainability, as well as on satisficing goals; and (iv) flexibility in supply chain activities. As LOFSC partners lack information about markets and supply chain activities and face limitations in adopting complex mathematical models, it may be appropriate to focus decision making on satisficing – acceptable and rational goals (Douma and Schreuder 2008, 125-126) instead of on optimisation.

The so-called problem structuring methods (PSMs), designed to reduce complexity and uncertainty and to support group-decision making (Rosenhead 1996), provide a candidate group of methodologies which meet the identified requirements for new approaches to design and manage LOFSCs.

Problem Structuring Methods

Van der Vorst (2000) describes supply chains as systems (Ackoff and Emery 1972). Systems Thinking (ST), also defined as the inquiry into systems, is a useful conceptual framework for understanding supply chains, as well as for intervening in supply chain design and management problem situations. ST includes two complementary traditions – hard and soft ST (Checkland and Scholes 1990, 25). Hard ST relies on quantitative, mathematical methods and is based on the idea that the world is systematic (Checkland and Scholes 1990, 25) and that problems can be adjusted to fit optimisation models in order to solve them (Wilson and Morren 1990, 109). The above-mentioned traditional supply chain design and management techniques can be classified as hard ST methods. Soft ST, on the other hand, aims to make sense of problem situations in order to understand, improve and change them (Checkland and Holwell 1998, 48). Goals of inquiry are considered to change constantly and to be conflicting (Wilson and Morren 1990, 111) so that problem situations need to be grasped from different points of view (Checkland and Holwell 1998, 48). Soft ST relies on qualitative approaches and human activity systems models that comprise human perceptions, behaviour, values, ethics and sustainability (Wilson and Morren 1990, 73-106; Kunsch et al. 2009; White and Lee 2009; Mingers 2011). Moreover, soft ST is based on facilitated processes of inquiry within a group of stakeholders (Checkland and Scholes 1990, 25) that are known as Problem Structuring Methods (PSMs). PSMs enable participatory problem definition, structuring, understanding and solving in complex situations of common interest (Rosenhead 1996; Taket and White 2000; Rosenhead and Mingers 2001). PSMs have not only been successfully applied to business redesign, strategic development, strategic change and innovation (Ormerod 1999) within individual organisations (Rosenhead 1996), but also within multi-organizational groups to strengthen cooperation, communication, negotiation and agreement (White and Taket 1997; Gregory and Midgley 2000; Taket and White 2000; Franco 2008, 2009).

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The suite of PSMs covers a range of methodologies (Rosenhead 1996) such as Interactive Planning (Ackoff 1999), Strategic Choice Approach (SCA; Friend and Hickling 1987), Strategic Options Development and Analysis (SODA; Eden 1989), and Soft Systems Methodology (SSM; Checkland 1981; Checkland and Scholes 1990), which we suggest to design and manage LOFSCs.

Soft Systems Methodology

The main reason for suggesting SSM lies in its potential to enable stakeholders to define problems logically and in detail, and to systematically take action for improvement (Checkland 1981). In particular, SSM addresses the four requirements for new approaches to design and manage LOFSCs listed above. As a PSM, SSM addresses the requirement (i) to develop and support relationships between LOFSC partners. The use of SSM enhances stakeholders´ participation and group-decision making, whilst it also supports inter-organizational cooperation, communication, negotiation and agreement. Concerning requirement (ii), SSM is a learning process that is not solely reliant on a facilitator's skill as it can also be taught to the stakeholders involved (Checkland 2001, 88). Stakeholders already know the simple language to develop conceptual models as activities necessary to improve problem situations are formulated as verbs; as activities familiar from daily life (Checkland 2001, 77). Facilitators may also adapt SSM to stakeholders' needs and capabilities in such a way that all feel comfortable and can make their way through intervention (Checkland and Scholes 1990, 302). SSM fulfils requirement (iii), to focus on ethical, moral and sustainability, as well as satisficing goals, because it is based on soft ST and may also include hard methods if appropriate and necessary (Checkland and Scholes 1990, 25). Concerning requirement (iv), SSM is flexible to use and can be shaped throughout intervention (Checkland and Scholes 1990, 1-7). Therefore, it enables flexibility, not only during intervention, but also in the implementation of change and the carrying out of supply chain activities.

Soft Systems Methodology – An Illustration

In the following section, we describe how SSM is applied in practice and illustrate a possible application to local organic food supply chain management based on a German case within the organic cereal sector (Bahrdt et al. 2002). The case serves to demonstrate how SSM may be used to intervene in problem situations and deal with uncertainties within LOFSCs.

An advisory company completed a project with the aim of describing the organic cereal sector in Germany and identifying challenges, barriers and uncertainties within related supply chains. Literature studies, expert interviews and telephone surveys with stakeholders were carried out to describe the organic cereal sector and to identify problem situations. In addition, workshops were organized with stakeholders to discuss the problem situations and identify possible actions for improvement. The advisory company looked at Germany as a whole in order to get a rich description of the organic cereal sector, but then narrowed down the perspective to the federal level to better understand the problem situations. For the latter purpose, the advisors carried out interviews and workshops with a limited number of representatives (1-5) from different supply chain stages and federal states. The representatives contributed especially with information from their local, regional environment. The German organic cereal sector is unstructured and includes sup-

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ply chains that are mainly based on small-scale enterprises. The project participants have identified three major problem situations: (1) poor communication between supply chain partners and end-consumers and poor communication and collaboration among supply chain partners; (2) lack of access to information about markets, supply chain partners and necessary supply chain activities; and (3) complexity of traceability and food safety requirements.

The process of SSM is a framework for facilitators to guide groups of stakeholders during intervention in problem situations. The stakeholders are here supposed to be local organic food producers and/or suppliers who aim to collaboratively reduce supply chain uncertainties in order to design and/or manage supply chains. LOFSC partners´ participation and engagement in SSM is useful, because it enables to jointly examine, understand and make sense of uncertainties, besides to agree on actions to alleviate them (Checkland and Scholes 1990; Rosenhead and Mingers 2001). It can be argued that the types of uncertainties faced by LOFSC partners correspond to those for which PSMs were developed. Of course, other PSMs may be considered as well; here we intend to present SSM as an example and a promising approach.

To provide a guideline for LOFSC partners to intervene in problem situations, we illustrate SSM as a staged process. SSM however is an iterative and a flexible process, which allows for switching between and repeating stages (Checkland and Scholes 1990, 284). The purpose of iteration is to elicit relevant knowledge and reflect it back in a structured form, and often it is the process that is most revealing. Outputs of interventions may be visible, e.g. models and action plans or invisible, e.g. a change in appreciation, learning and an improvement of relationships (Rosenhead 1996; Franco and Montibeller 2010). Successful interventions may facilitate and enhance long-term decision making and action among stakeholders.

Stage 1 — Rich Picture

The process of SSM starts with the composition of a rich picture to describe (ideally also pictorially) a problem situation of common interest (Checkland and Scholes 1990, 45). The stakeholders jointly draw the rich picture and aim to understand the problem situation from different perspectives, to emphasise structures, processes, relationships, conflicts and uncertainties (Checkland 1990, A16-A19; Wilson and Morren 1990, 106; 119-120) and to get a feeling of the situation. Stakeholders get a feeling of the situation because they express concerns, judgments and values and visualize abstract aspects through symbols (Checkland and Scholes 1990, 45) (Fig. 1).

Stage 2 — Cultural Analysis

Cultural analysis views the intervention itself as being problematic and identifies: (a) the structure of the intervention and its roles – Analysis 1, (b) connections between roles, values and norms – Analysis 2, and (c) political dimensions – Analysis 3 (Checkland and Scholes 1990, 45-51).

Within Analysis 1, stakeholders identify who is going to initiate the intervention and why it should take place, who intends to change and improve the problem situation based on what perceptions, knowledge and resources, and who may own the problem.

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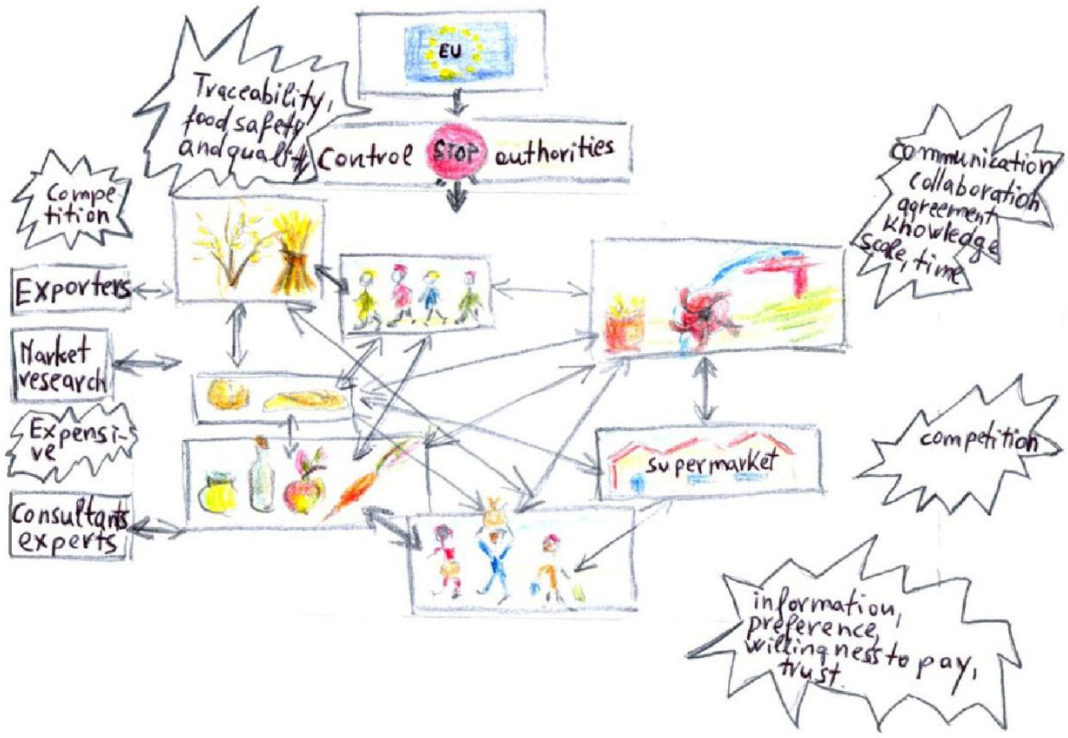

Figure 1. An example of a rich picture used as a facilitative device to support collective deliberation.

<u>Analysis 1:</u>

a) *Client*: food producers and/or suppliers participating in the German case
b) *Client´s aspiration*: improve communication and collaboration between supply chain partners and with end-consumers
c) *Problem solvers*: involved facilitator(s) (facilitators´ names), advisory company, and supply chain partners
d) *Resources available*: SSM; supply chain partners; information, knowledge and material available; duration of the project
e) *Constraints*: time; knowledge and information about LOFSCs; cultural environment
f) *Problem owners*: food producers and/or suppliers, involved supply chain partners, end-consumers, control authorities
g) *Implications of problem owner chosen*: the results of intervention must especially be useful to supply chain partners and end-consumers. Therefore, information regarding supply chain partners, as well as end-consumers, must be available. Involvement of end-consumers in a representative way is difficult to achieve. Therefore, existing empirical data about end-consumers should be analysed
h) *Reasons for regarding the problem as a problem*: loss in market opportunities; lack of product quality, supply chain coordination and efficiency
i) *Value to the problem owner*: improved communication and collaboration between supply chain partners and with end-consumers may increase supply chain coordination, efficiency and profit, whilst also supporting end-consumers' trust and decision making

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Within Analysis 2, stakeholders look at the problem situation as a social system. Here stakeholders have a specific social position, which is characterized by a specific socio-cultural behaviour. Analysis 2 not only serves to identify and describe the atmosphere within the intervention, but also to judge whether it is humanly good or bad (Checkland and Scholes 1990, 49) and seek to identify the reasons for a certain atmosphere (Georgiou 2008).

Analysis 2:

Socio-cultural behaviour among supply chain partners and end-consumers is characterized by:
- Tension
- Low team spirit
- Disorganized
- Reluctance
- Desire to communicate, collaborate, and improve
- Desire to meet customer demand

Within Analysis 3, stakeholders look at political dimensions typical for situations in which humans with different interests are involved. Stakeholders identify how power is expressed, obtained, maintained and passed on (Checkland and Scholes 1990, 50-51; Georgiou 2008).

Analysis 3:

Supply chain partners have:
- Power to change
- Power to hinder collaboration and communication (e.g. lack of information and knowledge, isolation and different opinions)
- Low power in larger markets (barriers and competitors)

Consumers have:
- Power to change buying behaviour
- Power to impact supply chain profit (low demand, buying frequency and expenditures; different preferences and lack of information)
- Power to impose demand (e.g. for information and prices)

Through Analysis 3, stakeholders become aware of the contradictory issue of being responsible for poor collaboration and communication and of being capable of changing problem situations. Finding out why stakeholders are responsible for poor collaboration and communication may clarify the actions necessary to achieve improvement.

In the case of supply chain design, we suggest Analyses 1, 2, and 3 as an approach to define the first part of the design of LOFSCs. In Analyses 1 and 2, local organic food producers and/or suppliers discuss the need to find and integrate further supply chain partners, who may be involved in the intervention process. In Analysis 3, the identified and cooperating supply chain partners discuss and decide who should be in charge of chain leadership and responsible for coordinating supply chain decisions. This stage is not illustrated here because supply chain design is not included in the German case.

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Stage 3 — Definition of Relevant Systems

Relevant systems, also called root definitions, describe in one or two sentences transformation processes of some entity into a new form of the same entity (Checkland and Scholes 1990, 33). Root definitions as planning statements describe the system to realize transformations, enhance change and improvement. This system should suit the problem situation of concern and its stakeholders in order to enable meaningful and innovative change. First, stakeholders identify transformations to reduce uncertainties. Second, the details of the transformations are defined through the CATWOE mnemonic. Finally, the root definitions are formulated (Georgiou 2008).

Formulations of Transformations (T):

Uncertainty 1 - example:
Difficulty in implementing marketing activities
T1: Poor marketing activities → marketing activities met

Uncertainty 2 - example:
Poor knowledge, information and expertise sharing between SC partners
T2: Poor knowledge, information and expertise sharing → knowledge, information and expertise sharing met

The same exercise is performed for each uncertainty identified within the rich picture.

CATWOE Based on T2:

C (customers – victims or beneficiaries): supply chain partners
A (actors who undertake T): supply chain partners
T: Poor knowledge, information and expertise sharing → knowledge, information and expertise sharing met
W (Weltanschauung – meaningful perspective): Knowledge, information and expertise sharing between supply chain partners supports collaboration and improves supply chain coordination. Openness benefits everybody and leads to increased financial returns
O (owners who might stop T): supply chain partners
E (environmental constraints): capabilities, culture, attitude, access to information

Root Definition:

A supply chain internal system to improve knowledge, information and expertise sharing between supply chain partners, in accordance with supply chain partners' needs and wishes, in order to support collaboration and improve supply chain coordination, by introducing new opportunities to share knowledge, information and expertise. The system operates in an environment in which supply chain partners have different capabilities, cultures, attitudes and limited access to information.

Stage 4 — Modelling Relevant Systems

Relevant systems are modelled as conceptual models (Figure 2), which are also known as purposeful human activity systems (HAS) that show the inter-linked human activities necessary to

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realize transformations. Human activities formulated as verbs depend on and influence each other, thereby building a structured plan for action (Checkland and Scholes 1990, 35-36). The HAS model (Figure 2) shows human activities to carry out the transformation T, i.e. to improve knowledge, information and expertise sharing between supply chain partners.

Action plans need to be evaluated before implementation in order to ensure their maintenance under uncertain, complex and dynamic circumstances. Checkland and Scholes (1990, 38-39) suggest the logical analysis including the 5 Es' to evaluate the feasibility of transformations and related human activities:

- *Efficacy* identifies whether the means work to realize T;
- *Efficiency* identifies whether the minimum resources are used to realize T;
- *Effectiveness* identifies whether T meets long-term aims;
- *Ethicality* identifies whether T is moral;
- *Elegance* identifies whether T is aesthetically pleasing.

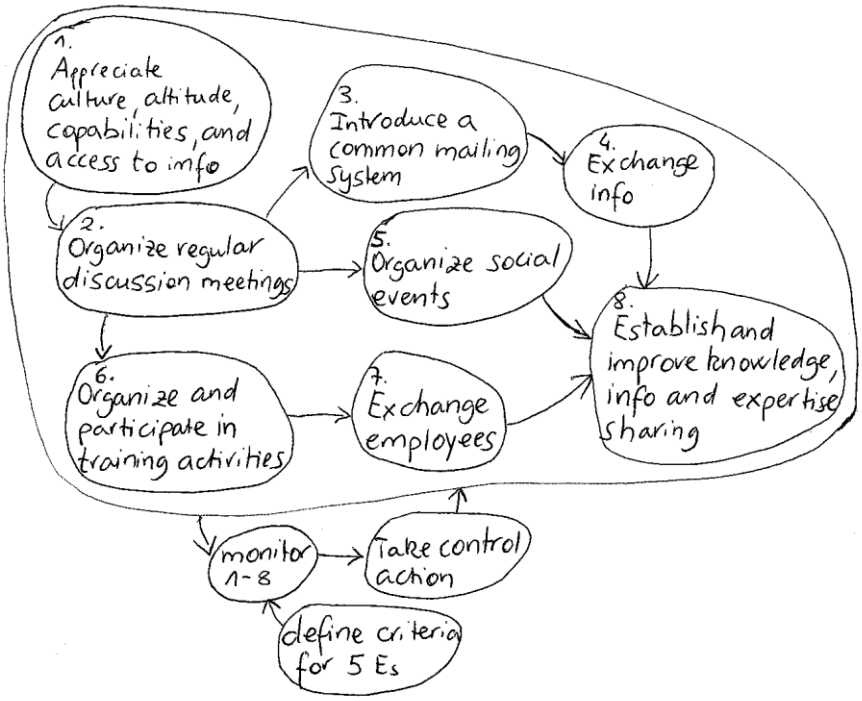

Figure 2. An example of a human activity system (HAS) used to facilitate collective design and discussion processes.

<u>Logical Analysis for HAS in Figure 2:</u>

Efficacy: Collaboration and supply chain coordination are increasing
Efficiency: Knowledge, information and expertise are shared at minimal costs
Effectiveness: Knowledge, information and expertise are shared
Ethicality: Supply chain partners act with social and moral responsibility
Elegance: Knowledge, information and expertise sharing enables obstacle free collaboration

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In line with Checkland and Scholes (1990, 25; 31-32) and Wilson and Morren (1990, 107; 110), conceptual models can be completed or replaced by quantitative models. Therefore stakeholders can at this stage choose between qualitative and quantitative models depending on the uncertainty and the supply chain activity of concern.

In the case of SCD, supply chain partners design here the second part of supply chains (resulting from stage 2), i.e. identify the location of production sites and facilities, facility capacity and transportation means.

Stage 5 — Comparison of Conceptual Models with the Real World

Stakeholders compare conceptual models with the real world by answering questions such as, "Does the activity in the model exist in the real world? How is it done? By what criteria is it judged?" (Checkland 2001, 83-86) (Table 1). Comparison allows ideas for change to be debated so that new ones eventually emerge and finally agreement is achieved as to how to implement change and realize improvement (Checkland and Scholes 1990, 43-44).

Table 1. Comparison of Conceptual Models with the Real World

Activity in Model	Exists?	How?	Who?	Good or Bad?	Alternatives?
Organize regular discussion meetings	No, not regularly	Occasional discussion occurs between individual SC partners	SC partners	Current discussion is bad	Organizing regular meetings along the entire SC is a new opportunity
Introduce a common mailing system	No				Introducing a mailing system is innovative
Organize social events	No				Organizing social events is innovative
Exchange information	Yes	Information is exchanged as part of traceability requirements	SC partners	Current exchange of info concerning traceability is good	Exchange of info should also occur apart from traceability

Note. Each activity in the human activity system is to be compared with the real world. This table only provides an example.

Stage 6 — Formulation of Changes

As a result of stage 5, stakeholders formulate changes that are systematically desirable and culturally feasible; changes that are relevant, meaningful and that meet stakeholders' needs and wishes (Checkland 2001, 85-86) (Table 2).

The process of SSM may be seen as innovative compared with the research approach used within the German case because SSM relies on visual methods (e.g. rich picture and HAS) and means (e.g. boxes and tables) to provide compact, clear and easily accessible information. Visual mate-

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rial allows stakeholders to share different perceptions, ideas, and issues, and to better understand complex relationships. Dialogue and debate which is based on visual material may, thus, be more efficient than purely oral dialogue and debate (White 2006). Visual material improves stakeholders´ engagement because they see how their input is considered to increase richness and take action (Franco 2006). It is also useful to define and assess milestones, see what has been addressed and identified in order to keep track of progress (Ackermann 1996), support decision making and accelerate the implementation of change.

Table 2. Formulation of Changes

How	Desirable?	Feasible?	Possible Action
Organize monthly discussion meetings	Yes	Yes	Find location; select an organizing committee; select discussion topics. Who will carry out the actions and by when?
Exchange employees	Yes	Yes	Describe employees' profiles; exchange profiles; set up a plan. Who will carry out the actions and by when?
Organize product information days	Yes	Yes	Find location; provide product descriptions; discuss production and marketing practices. Who will carry out the actions and by when?
Exchange product information	Yes	Yes	Provide product descriptions; circulate e-mails. Who will carry out the actions and by when?

Stage 7 — Take Action

Stakeholders take action to implement change and improve the problem situation through recycling the SSM process (Checkland 2001, 86).

Methodological Reflections and Conclusion

Local organic food supply chain partners face uncertainties such as poor collaboration, communication and information sharing that cannot be controlled and reduced through quantitative supply chain design and management techniques. Such techniques are expensive and complex to use and do not adequately consider major aspects of LOFSCs such as ethics, sustainability and human values. Systemic, structured, and facilitated approaches to reduce uncertainties within LOFSCs, support supply chain design and management are lacking and need to be developed.

Researchers have discussed the benefits of using systemic, structured and facilitated approaches for problem solving and decision making. Systemic and structured approaches enable stakeholders to enter problem situations from a complete, wide ranging perspective, to gain clarity in thought, will and deed. Moreover, systemic and structured approaches not only structure the process of intervention and the complex problem situation, but also structure the process of thinking and change (Mingers and Taylor 1992). These approaches also help facilitators guide stakehold-

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ers during exploration with a focus on the problem situation in order to achieve progress (Ackermann 1996).

Facilitators guide stakeholders in a constructive direction, refresh them with energy (Phillips and Phillips 1993) and deal with different personal interests and dominating personalities (Ackermann 1996). Facilitators not only manage the complexity of problem situations, but also of human relations manifested during intervention (Rosenhead 1996). Their aim is to understand group life (Phillips and Phillips 1993, 541), and ensure stakeholders' free contribution and equal participation (Ackermann 1996). Free contribution and equal participation increase stakeholders´ motivation, ownership and commitment to decisions and actions for change (Ackermann 1996; Gregory and Midgley 2000).

The aim of this paper was to suggest SSM as a suitable approach to design and manage LOFSCs. Based on theory and the illustration of a German case, the paper has illustrated how SSM may be used to tackle uncertainties within organic FSCs that are mainly based on small-scale enterprises. In order to identify the benefits of using SSM, we shall consider what it might have evoked, if applied to the German case. The case mainly reports uncertainties that need to be approached through dialogue and consensus. Case participants express a need for change, improvement and innovative approaches to deal with difficulties to communicate, agree, learn and understand. The research approach used within the case enables participants to better understand the problem situations and uncertainties. The case report, however, does not mention any increase in communication and agreement as a result of the research approach. Participants come up with innovative ideas about how to improve the problem situations, but these are only formulated as suggestions (Bahrdt et al. 2002, 67-69) and not as agreed and planned actions.

Soft Systems Methodology is a structured learning approach that enables stakeholders to better understand and structure problem situations, evolve strengths, agree on action plans for improvement, and engage for intended change and innovation (Checkland and Scholes 1990, 3). The process of SSM is just about purposeful, every-day thinking, but it provides better organisation and structure. Stakeholders explicitly formulate ideas, follow a path towards results and may share, trace and recall ideas at any time (Checkland and Scholes 1990, 300-302).

The case report is more a detailed description of the German organic cereal sector than a plan to take action, but it can be seen as an input for future activities. From our point of view, SSM and the identification of who is going to do what and how, would have added an action-oriented perspective to the suggestions to improve problem situations. SSM might have supported the participants in agreeing on actions to tackle the problem situation and carrying out the suggestions they made. The participants formulated suggestions using verbs such as "could" or "should", whereas the use of SSM would have generated feasible and desirable options for change based on active verbs. Through SSM, stakeholders get ready to act for change and improvement because Analysis 1, CATWOE, root definitions and conceptual models clarify who does *what* (T in CATWOE), *how* (activities in HAS), *under what constraints* (E in CATWOE), *with what resources* (point d in Analysis 1), and *why* (points h and i in Analysis 1; W in CATWOE). Knowing why in particular and clarifying the meaning and value of ideas motivate stakeholders to decide, take purposeful action and engage for improvement (Checkland 1990, A39).

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The use of SSM implies further benefits: rich pictures and Analyses 1, 2, and 3 extract tacit knowledge from stakeholders, which is valuable for improving problem situations (Georgiou 2008). Within Analysis 2, stakeholders identify and discuss the atmosphere of intervention and abstract aspects that *a priori* might not be obvious. Stakeholders become aware of emotional relations between each other that not only help explain and structure uncertainties, but also enhance motivation to act for improvement. Analysis 3 supports stakeholders in identifying their power and competences. Awareness of being able to change problem situations, but also to hinder change – which might not be obvious to all stakeholders – may enhance further engagement and motivation. The identification of power may also increase learning among stakeholders because learning is considered to be especially productive when it is done by those who have the power to act (De Geus 1988).

Checkland (1990, A14) points out that the formulation of ideas is not enough to enable action, but that "debate structured by questioning perceptions of the real situation by means of purposeful activity models" enables action. A comparison of models with the real world enhances discussion about which activities already exist, which need to be expanded, and which to be introduced. Additionally, comparison identifies different stakeholders' attitudes to actions and aims at achieving conciliation between conflicting stakeholders (Checkland 1985). Conciliation leads stakeholders to agree upon how to act, formulate and implement changes that are systematically desirable and culturally feasible. Changes to improve problem situations need to be desirable and feasible, and to meet supply chain partners' needs and wishes. Only desirability and feasibility will enable and motivate supply chain partners to engage in the implementation of and benefit from change.

Decision making, change and innovation within LOFSCs need to consider ethics, sustainability and human values. The use of SSM enables intervention with a focus on sustainability, ethics and human values: action starts from the problem situation of concern, builds on related characteristics and leads to desirable, feasible, ethical and elegant change (5 Es'). Besides, Analysis 1 identifies values for intervening in problem situations; Analyses 2 and 3 look at human relations and behaviour; root definitions clarify human needs and wishes, whilst they also consider human aspects such as capabilities, culture and attitudes. The importance of human aspects within LOFSCs is also expressed through socially embedded relationships and personal communication between suppliers (Hinrichs 2000; Marsden et al. 2000; Sage 2003). Personal communication can be improved through the participatory and facilitated conversational processes adopted in the use of SSM. Conversation enables stakeholders to share knowledge and different perspectives, thus to enhance learning and collaborative efforts. Collective learning has been found useful to strengthen organizational identities, as well as power to manage resources and relationships among suppliers (Hinrichs 2000; Marsden et al. 2000).

Drawing on the illustration of the use of SSM in the German case and the preceding discussion, it can be argued that SSM is a promising approach to tackle uncertainties within LOFSCs. We recognize the findings reported here are based on a conceptual study, which poses limitations to their generalizability and transfer to practice. Based on a thorough literature study we have, however, attempted to provide insight into the potential of SSM and its use in LOFSC management. Empirical work in this area is needed and practical applications of SSM in LOFSCs are to be encouraged. Practical applications would not only be of value to further investigating the potential

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of SSM to design and manage LOFSCs, but also to attract more researchers and practitioners to access this area. Moreover, the use of SSM as an intervention tool could be considered for other types of food supply chains as well, in which 'intangible' uncertainties dominate. Overall, it can be argued that SSM is also a suitable approach to intervene in other 'ill-defined' supply chain situations, but here it is the particular nature of LOFSCs – socially embedded relations, personal communication, and the focus on sustainability and ethical values – which supports our suggestion.

Can we be sure that SSM will trigger better results? As Checkland (1990, A12) emphasizes, "…any methodology which will be used by human beings cannot, as methodology, be proved to be useful". Successful use of SSM does not necessarily mean that results are quantifiable or objectively evaluable. Success may also result from the potential of SSM to identify problem situations, change stakeholders´ perceptions, increase stakeholder involvement, build and strengthen relationships, share values and enable change (Mingers and Taylor 1992; Rosenhead 1996; Connell 2001; White 2006).

This paper has illustrated how SSM may be used to tackle problem situations, and to design and manage LOFSCs. It has, furthermore, attempted to identify the benefits of using SSM compared with less 'systemic' and structured approaches. SSM is a promising approach to enable stakeholders to reduce uncertainties within LOFSCs, support coordination and enhance efficiency.

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