

**Transdisciplinary Co-Production of Knowledge
in the Development of Organic Agriculture in Switzerland**

Inauguraldissertation
der Philosophisch-naturwissenschaftlichen Fakultät
der Universität Bern

vorgelegt von
Andrea Aeberhard
von Jegenstorf BE

Leiter der Arbeit:
PD Dr. S. Rist
Prof. Dr. U. Wiesmann
Centre for Development and Environment CDE
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Prof. Dr. U. Feller

Summary

In a world where the long-term damage and disadvantages of industrialized land use and food production have become clear, and where at the same time there is a great need to nourish a continuously increasing population, the development of sustainable forms of agriculture and food production is a major challenge for society. Organic agriculture is one successful answer to this challenge. Effective development and implementation of farming concepts depend on including the specific knowledge systems of all involved actors. On the one hand transdisciplinary research has become an important approach for examining interactive co-production of knowledge for more sustainable forms of agriculture. On the other hand, transdisciplinarity provides a series of principles that allow for better understanding of the ways, potentials, limitations, and challenges of different forms of knowledge co-production in sustainable agriculture as reflected in interactions among science extension, farming, consumers, retailers, and policy-makers.

Organic farming, which is recognized today as a sustainable and ecological form of agriculture, has exhibited very interesting forms of joint knowledge generation throughout its history. Although organic agriculture has not explicitly followed a transdisciplinary approach, its development is indeed a highly interesting case of collaborative knowledge production. Thus, analysis of it can provide insight into different processes of knowledge co-creation and the factors that influence the degree of transdisciplinarity at different times. Against this background, the main objective of the present thesis was to analyse how knowledge co-production was organised in the development of organic farming. A major focus of the study was the investigation of aspects that enable or inhibit collaboration among important actors in knowledge co-creation. This was done with the purpose of providing empirical evidence for the potentials and constraints of a long-term and large-scale case of transdisciplinary knowledge production, represented by organic agriculture. Furthermore, the results are intended to provide a conceptual and empirical framework to which the community supporting organic agriculture and sustainable agriculture in general can relate more systematically in future.

In a first step analysis of data was based on Fleck's concept of thought styles and thought collectives, which allowed identification and characterisation of the different actor groups involved in knowledge production processes. The theoretical foundation of transdisciplinarity was used to identify corresponding forms of collaboration in the development of organic farming in Switzerland. Analysis of different influences from inside and outside the organic movement on knowledge co-production was premised mainly on power theory, involving five power types as defined by French and Raven. The notion of institutionalization was applied to gain understanding of the evolution of relationships and knowledge creation between members of the organic movement and external actors.

The present research work is based on qualitative research methods in order to be able to fully take into account participants' knowledge and practices and the different perspectives and viewpoints of actors and researchers. The research process involved the following iterative

steps: critical case sampling (actor selection); document analysis, semi-structured interviews, direct participation (data collection); transcription and thematic coding (data processing); and data evaluation, with interdependence among the individual steps. The critical case sampling revealed key actors, i.e. scientists, extension agents, farmers, and policy makers in the Swiss organic farming movement, who have particular knowledge about the interrelationships between practice, science and the political world in organic agriculture. This is a critical function of my study on collaborative knowledge production in organic farming. Data collection for the present thesis was based on a triangulation procedure, i.e. extensive analysis of documents and materials originating from different perspectives on the organic farming movement, and on eighteen semi-structured and multi-hour face-to-face interviews with selected key actors in organic agriculture, including pioneers of organic farming and related organisations. Furthermore, I had the chance to engage in participatory observation by visiting farms and meeting actors in the framework of workshops and seminars on organic farming topics. The interviews were digitally recorded and transcribed, and data processing involved the clustering of thematic data categories.

Article I (Transdisciplinary co-production of knowledge in the development of organic agriculture in Switzerland) and article V (Koproduktion von Wissen in der Entwicklung des Biolandbaus - Einflüsse von Marginalisierung, Anerkennung und Markt) involve analysis of transdisciplinary co-production of knowledge in different phases of the development of organic agriculture in Switzerland. Transdisciplinary co-creation of knowledge has been analysed using Fleck's theory of thought styles and thought collectives. Examination of the data revealed three different thought collectives, namely farmers, scientists and extension agents. Moreover, three different phases can be identified throughout the historical development of organic agriculture. The initial phase, lasting from the beginning of the 1920s to the early 1970s exhibits numerous characteristics of diverse, well-established concepts of transdisciplinarity and represents a successful transdisciplinary process which has not been perceived as such in past and present scientific discussion on organic agriculture. The second and third phases show increasing segregation of thought collectives caused by internal changes such as the establishment of specialised research institutions and external processes like agriculture policy and market development. These developments led to a diminishing degree of transdisciplinarity. We observed an ambiguous trend: the continuously growing and now well-established positive societal recognition of an initially little-accepted newcomer movement is now characterised by the gradual loss of its very valuable forms of knowledge co-production and the related philosophical background. To overcome this dilemma, the various forms of transdisciplinary knowledge generation – which were unconsciously created under the supporting circumstances of a movement of people with a common aim and under conditions that inherently demand transdisciplinarity, namely uncertainty, controversy and complexity – should be institutionalized. Otherwise they will be lost as soon as conditions become less favourable, as was the case in organic farming with segregation of thought styles, which separated research from practice, and with external influences. Thus, in order to re-establish successful knowledge production processes, there must be reflection not only on the corresponding results or outcomes but also on the whole cooperation process which has led to these results.

The second paper (article II: Power and Knowledge Co-Production – A Case Study of the Development of Organic Agriculture in Switzerland) addressed the question if and in what way power relations played a role in the above-mentioned ambiguous development throughout the three phases of knowledge co-production in organic farming. Analysis revealed that over time there has been a significant shift from controlling power relations within the organic movement towards asymmetries of power between the organic community and related external actors such as retailers, policy-makers, and scientists. It was shown that power impact of actors outside organic agriculture has a predominantly inhibiting influence on joint knowledge production. Examples include the influence of the reward power of governmental incentives or the retail trade, which shifted the interest of farmers from the philosophical background and advancement of the organic movement towards a focus on more economic thinking, or the shift of expert power from farmers and organic scientific institutions to traditional specialised agriculture research institutes. Thus, the great increase in external power influences in the third phase is identified as an important reason for the diminishing intensity of transdisciplinary knowledge creation.

In the third and fourth articles (article III: The Influence of Institutionalization on Collaborative Knowledge Production in the Development of Organic Farming in Switzerland; article IV: Transdisziplinäre Wissensproduktion im Biolandbau) key actors' views and visions on present and future phenomena in organic agriculture are analysed against the background of institutionalization processes in organic farming in connection with present and future knowledge co-production. The process of institutionalization of organic concepts in association with growing societal, economical and political acceptance, which is a very positive development, has nevertheless led to a loss of some of the original ideas of the pioneers of organic farming. Yet this corresponds to a common development in innovation processes or social movements. However, the empirical data clearly show that the actors interviewed were concerned about the decrease of knowledge exchange and loss of original ideas and philosophies. Based on critical analyses, the articles suggest that –initially active joint knowledge creation should be re-intensified through concepts of transdisciplinarity in a way that suits today's institutional framework conditions.

Summarizing the results, the thesis reveals that, various features of transdisciplinary knowledge production have been lost during the development of organic farming from an outsider movement to a recognized sustainable form of agriculture, and the intensity of joint knowledge creation among actors in the organic community has gradually diminished. This development has been partly triggered by processes of institutionalization in organic farming and growing external determination, especially with regard to classical disciplinary research, certification processes, and market expansion. The observed loss of the original principles of the organic movement has led to increasing conventionalization of organic farming and thus to a decline of sustainability, for example in the gradual loss of farmers' holistic view of the agricultural system. The key actors in organic farming interviewed regret this development and would appreciate a revival of knowledge exchange between science and practice. The most adequate instrument for reversing this trend is reflection on and implementation of current transdisciplinary concepts, which involve mutual recognition of the different involved

actors and understanding of correspondingly different thought styles. In addition, power relations have to be taken into account, since the great increase in external power control in the third phase is a very important reason for the diminished intensity of collaborative knowledge co-production. It is therefore necessary to convince external actors and institutions involved in organic farming to rely on co-management, including more participatory and democratic forms of knowledge production. This way, the original strengths of organic agriculture in co-producing knowledge could be reconstructed on the level of today's institutional framework conditions and constitute an essential step towards more ecological and sustainable forms of agriculture in the future.

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Andrea Aeberhard, in August 2009

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Article I (peer-reviewed)

Aeberhard A. and S. Rist, 2009. Transdisciplinary co-production of knowledge in the development of organic agriculture in Switzerland. *Ecological Economics* **68**: 1171-1181.

Article II (peer-reviewed)

Aeberhard A. and S. Rist, 2009. Power and Knowledge Co-Production – A Case Study of the Development of Organic Agriculture in Switzerland. Submitted to *Ecology&Society* [in review].

Article III (peer-reviewed)

Aeberhard A. and S. Rist, 2009. The Influence of Institutionalization on Collaborative Knowledge Production in the Development of Organic Farming in Switzerland. Submitted to *Journal of Rural Studies*.

Article IV (peer-reviewed)

Aeberhard A. and S. Rist, 2009. Transdisziplinäre Wissensproduktion im Biolandbau. *Agrarforschung* [in press, October edition 2009].

Article V (peer-reviewed)

Aeberhard A. and S. Rist, 2009. Koproduktion von Wissen in der Entwicklung des Biolandbaus - Einflüsse von Marginalisierung, Anerkennung und Markt. In: Mayer, J.; Alföldi, T.; Leiber, F.; Dubois, D.; Fried, P.; Heckendorn, F.; Hillmann, E.; Klocke, P.;

Lüscher, A.; Riedel, S.; Stolze, M.; Strasser, F.; van der Heijden, M. and Willer, H., (Hrsg.) (2009) Werte – Wege – Wirkungen: Biolandbau im Spannungsfeld zwischen Ernährungssicherung, Markt und Klimawandel. Beiträge zur 10. Wissenschaftstagung Ökologischer Landbau, Zürich, 11.-13. Februar 2009 (vol 1). Berlin, Dr. Köster Verlag, (<http://orgprints.org/14377/>).

Conference Paper I

Aeberhard A., F. Schneider and S. Rist, 2007. Knowledge production and dissemination in sustainable agriculture as a transdisciplinary process – experiences from Switzerland. In: Erpen D. (ed), Enlarging the Knowledge Society. *Proceedings of the ESSHRA European Research Conference 12th-13th June 2007*. Berne, Switzerland.

Conference Paper II (with oral presentation)

Aeberhard A. and S. Rist, 2008. Collaborative research in the development of organic agriculture in Switzerland – a case study. In: Daub H., P. Burger, Y. Scherrer (eds), Creating Values for Sustainable Development. *Proceedings of the 2nd International Sustainability Conference 21st – 22nd August 2008*. Basel, Switzerland.

Conference Poster Session (with oral presentation)

Aeberhard A. 2009. Transdisziplinäre Koproduktion von Wissen im Biolandbau in der Schweiz. *10. Wissenschaftstagung Ökologischer Landbau, Werte – Wege – Wirkungen: Biolandbau im Spannungsfeld zwischen Ernährungssicherung, Markt und Klimawandel, 11.-13. Februar 2009*. ETH Zürich, Switzerland.

Oral presentations at scientific colloquia

Forum Entwicklung und Umwelt (CDE), 14. November 2007, Geographisches Institut, Hallerstrasse 12, 3012 Bern, “Transdisziplinäre Koproduktion von Wissen in der Entwicklung des Biolandbaus in der Schweiz“.

Forum Entwicklung und Umwelt (CDE) zum Thema ‘Innovation und nachhaltige Entwicklung: Unsere Chance’, 5. November 2008, Geographisches Institut, Hallerstrasse 12, 3012 Bern, “Koproduktion von Wissen in der Entwicklung des Bio-Landbaus in der Schweiz - Fallstudie einer landwirtschaftlichen Innovation”.

Fleckkolloquium, 22. April 2009, ETH Zürich, Collegium Helveticum, Ludwik Fleck Zentrum, “Transdisziplinäre Koproduktion von Wissen in der Entwicklung des Biolandbaus in der Schweiz unter Einbezug von Flecks Konzepten der Denkstile und Denkkollektive“.

Introduction

The present doctoral thesis deals with knowledge production in the development of organic agriculture in Switzerland. In particular, it focuses on collaborative knowledge creation by actors in practice, research, and extension services in different stages of the history of the organic movement, and discusses observed forms of transdisciplinarity within this interplay. It investigates different influences on changes in the processes of co-production of knowledge, such as the development of diverse ways of thinking, and the impacts of asymmetric power distribution. Based on the study's findings, recommendations are made for successful further development of joint knowledge production in organic agriculture.

Research background

The present research project, conducted for a doctoral thesis at the Centre for Development and Environment, which is part of the Institute of Geography of the University of Bern, under the supervision of PD Dr. Stephan Rist and Prof. Dr. Urs Wiesmann, was assigned to the National Centre of Competence in Research North-South (NCCR North-South). This comprehensive research programme addresses issues relating to sustainable development, particularly in developing and transition countries, but also in Switzerland. One of its major aims in relation to the Swiss agricultural sector is investigation of knowledge systems and negotiation processes involving farmers, researchers and experts. The absence of negotiation processes may be explained by a number of factors, including differing perspectives and interests, the lack of possibilities for interaction, or a lack of acceptance of farmers' knowledge (NCCR North-South 2007: 37). The present study addresses these questions in relation to knowledge co-production by farmers, scientists, and extension agents and other concerned actors in organic farming in Switzerland.

Organic agriculture and sustainability

While agriculture policy for decades focused on raising productivity and production, it has become clear that this perspective took insufficient account of impacts on the environment, human health, and social well-being (Waltner-Toews and Lang 2000) and does thus not consider common criteria of sustainability. In the recently updated version of *Limits to Growth*, Meadows et al. (2004) list parts of their vision for a future sustainable society. Among other things, this list contains the following propositions: regenerative agriculture that builds soils, uses natural mechanisms to restore nutrients and control pests, and produces abundant, uncontaminated food; greater understanding of whole systems as an essential part of each person's education; and human cultures living in harmony with ecosystems. These points are fully in accordance with the original ideas and visions of organic agriculture. Thus, organic farming can be seen as one successful form of sustainable agriculture and an answer to the above-mentioned problems of industrialized agriculture. As such, it has gained importance in agricultural policy since the 1990s, along with the growing global concerns about sustainability and ecology in societal and political discussions. The global movement of organic agriculture in its certified version today covers about 32 million hectares managed by 1.2 million producers, including many smallholders, and represents a global market that

reached a value of over 46 billion USD in 2007 (Willer and Kilcher 2009). In Switzerland, about 11% of the total area devoted to agriculture and 20% of mountainous areas are cultivated by approximately 6000 organic farms. Moreover, taking into account that many so-called 'traditional' forms of agriculture in Southern countries are often congruent with the basic principles of organic agriculture, it can be assumed that a large number of the approximately 388 million families practicing 'small-scale agriculture' on less than two hectares are engaged in a sort of 'hidden' organic food production (Rist 2000).

Numerous scientific studies worldwide have demonstrated the advantages and benefits of organic farming as an essential form of sustainable agriculture. Organic agriculture has a significant positive impact on biodiversity and soil fertility (Hole et al. 2005, Fuller et al. 2005, Macilwain 2004, Mäder et al. 2002). Analyses reveal, for example, that organic cultivation entails on average 30% to 50% more species of flora and fauna than conventional land cultivation (Bengtsson et al. 2005). Also, a mechanism has recently been identified that explains how organic agriculture supports biodiversity: prevention of nutrient enrichment by fertilizers in organic farming avoids the biodiversity loss caused by eutrophication through the decrease of light reaching the grassland understory (Hautier et al., 2009). Organic food production also involves various benefits to human health. For instance, while better taste is difficult to quantify scientifically, the advantage of the absence of known unhealthy components such as residual antibiotics, growth hormones and pesticides in organic food is obvious, since these are not used in the organic production chain (Magkos et al. 2003, Williams 2002). Moreover, with respect to the problem of global warming, organic farming supports fixation of carbon or CO₂, respectively, in soil and thus, together with less energy use than conventional agriculture, helps to mitigate climate change (Chen et al. 2006, Fliessbach et al. 2006).

Beside these aspects, one of the major criteria for organic agriculture is respect for the social and economic needs of farmers, leading to pricing systems where market aspects (supply and demand) are only one factor among others in the determination of prices and incentives. Moreover, it is important to keep in mind that behind the increase of cultivated area and market volume in organic farming, we find a global network of engaged people organized in a highly diverse 'organic universe' that comprehends alternative consumer and farmer associations, small to large retailers, environmental groups, fair trade organizations, researchers, and groups of policy-makers. Against this background, organic farming inevitably requires addressing societal and political issues that transgress the boundaries of purely natural or economic science perspectives (Morgan and Murdoch 2000, Kaltoft 2001, Rist 2003). Thus, beyond the question of how agriculture and food production can become more environmentally friendly within the framework of current economic and social conditions, one has to ask how to induce societal and political changes that support the development of organic agriculture (Rist 2003).

Since its beginning, the development of organic farming has been comparable to a social movement, which can be described as a network of individuals, groups, or organisations engaged in political or cultural issues on the basis of a shared collective identity (Della Porta

and Diani 2006). Social movements are an increasingly prominent feature of rural politics and social action, attracting growing attention from researchers in the field of rural studies and sustainability research (Woods 2008). In the course of its development, the organic farming movement has undergone a process of institutionalization, expressed, for example, by the founding of a research institute for organic agriculture, the formation of cultivation and marketing organisations, the definition of labels and guidelines, the introduction of governmental incentives for ecological farming, and growing acceptance in society, policy, and the common retail trade.

Collaborative knowledge production in organic farming

Within the field of sustainability science, which seeks to understand the basic characteristics of interactions between nature and society (Kates et al. 2001), there is a growing consensus that the types of knowledge generated by science and society have become increasingly interdependent (Elzinga 1997, Grunwald 2004, Jasanoff 2004) and that knowledge production cannot be perceived as the result of a linear process in which solutions proposed by science determine actions taken outside of the scientific community (Roux et al. 2006). As a consequence, the relationship between science, society and policy is explained as the outcome of a process of co-creation of knowledge through which actors affirm their identities and the legitimacy of their claims and practices (Luks and Siebenhüner 2007). Concepts of transdisciplinarity provide an adequate framework for addressing the interrelationships among actors in organic farming such as practitioners, scientists, extension agents, and policy-makers. It involves including members of the scientific and non-scientific communities as well as their knowledge (Nowotny et al. 2002, Clark and Dickson 2003, Cash et al. 2006) working jointly to solve a real-world problem (Klein et al. 2001). Moreover, transdisciplinary modes of knowledge co-production involve problem-solving strategies that must be based on close interaction between scientists and other involved actors. This overcomes the pitfalls of a one-dimensional and linear interconnection between science and society, which fails to address concepts of complexity and plurality.

In this sense, the present research project investigates in which way knowledge co-creation in organic agriculture can be understood as an example of transdisciplinary knowledge production. Although organic agriculture has not explicitly followed a transdisciplinary approach, its development is indeed a highly interesting case of knowledge co-production. Analysing it can thus provide insight into different processes of co-creation of knowledge and the factors that influence the degree of transdisciplinarity in different phases of its development. It is essential to establish an interrelationship between the history of organic farming and the principles of transdisciplinarity. The most adequate methodological instrument for the analysis of this interface, and the complex networks of different actors and actor groups which are involved in the development of organic farming, is Fleck's theory of thought styles and thought collectives (2002). Inclusion of the social and historical context, which is a crucial element of Fleck's theory and inherently belongs to a scientific process – but nevertheless is often neglected by science – makes it possible to approach the complex interrelationships of thought collectives and corresponding thought styles in the most appropriate way. With regard to the question of the connection between transdisciplinarity

and Fleck's concepts of thought styles and collectives, it could be shown that the theory is also particularly adequate for characterising scientific as well as non-scientific actors and their specific modes of perception and interpretation. Moreover, Fleck emphasizes the importance and significance of practical knowledge. Thus, understanding of knowledge co-production as the result of interaction between the members of thought collectives that emerged in the course of the development of organic agriculture, and understanding of the history of organic farming as a development of thought styles and thought collectives, help to show the inherent potential for innovation of transdisciplinary knowledge produced by organic agriculture.

While the historical development of organic agriculture is treated in several scientific studies (Moser 1994, Koepf and Plato 2001, Vogt 2001, Schaumann et al. 2002), a systematic analysis of the interrelationships between practitioners, researchers and extensionists in organic agriculture in Switzerland has been neglected to date. Examination of the history of organic farming reveals several forms of collaboration between different actors in knowledge production, which were commonly applied but not conceptualized as such. For these reasons, the present study analyses the development of organic farming with a focus on the (extent of) co-production of knowledge and its relation to principles of transdisciplinarity. This first of all allows us to analyse a long-term example of transdisciplinary co-production of knowledge and its evolution over time, which contributes to a better understanding and management of transdisciplinary approaches in knowledge production. Secondly, it might support reflection on the importance of knowledge production processes by the members of the organic farming community and thereby the future development of the organic movement. Thus, the aim of this analysis is to contribute to an empirical basis for debates about the fundamental conditions, potentials and shortcomings of co-production of knowledge. Moreover, this thesis investigates the different factors that influence the intensity of transdisciplinarity in an enabling or inhibiting way. For this purpose, we focus on the influence of power relations related to the development of knowledge co-production in organic farming. Concepts of power are of interest to numerous fields of social science and represent a very useful theoretical framework for analysis of transdisciplinary knowledge production. The importance of power relations has already been demonstrated by pointing out unequal participation in knowledge production processes in agriculture (Morgan and Murdoch 2000, Derkzen and Bock 2007). The present research study tests the hypothesis that power imbalances play an important role in knowledge co-production processes and, in particular, that asymmetric power relations may be possible reasons for changes in the intensity of co-production of knowledge in organic agriculture. A second focus is on the influence of the institutionalization processes observed throughout the history of organic agriculture in collaborative knowledge production.

In this sense, the present thesis offers a conceptual and empirical framework to which the community supporting organic agriculture and other fields of sustainability science can relate more systematically in future. It will help to support the high potential for innovation in the organic movement and to find strategies to facilitate future co-creation of knowledge, and hopefully contribute to the emerging field of innovative re-conceptualizations of the relationship between science and society.

Theoretical framework

Analysis of the empirical data from the research study was supported by four different theoretical frameworks, which were applied in different stages of the study. The first analytical step, which was the identification of actor groups and their development during the history of organic farming, was supported by Fleck's (2002) theoretical concepts of thought collectives and thought styles. The next phase of the research work involved characterisation of the interrelationships and forms of knowledge production between the identified thought collectives, and the corresponding changes in the course of the history of organic farming employing specific concepts of transdisciplinarity. Moreover, based on the power concepts of French and Raven (1959) and Raven (1993), the study investigates how power relations play a role in the process of knowledge co-production and how they enable and inhibit the intensity of knowledge exchange in the development of organic agriculture. In a last step, the study compares the development of organic farming to a social movement and examines how it constitutes a process of institutionalization and what implications this may have for the future development of knowledge co-production in organic farming.

Below is a more detailed description of the theoretical concepts introduced above, which support analysis of the empirical material in this research study.

Thought styles and thought collectives

The classical concepts of thought styles and thought collectives introduced by the Polish microbiologist and physician Ludwik Fleck are an excellent theoretical framework to compare different knowledge systems which have been generated, developed and (re-) conceptualised in the development of organic farming. Fleck defines the notions of thought styles and thought collectives as historically developed, sociologically determined and interrelated phenomena, which are continually evolving, mostly without the consciousness of the concerned actors (Schäfer and Schnelle 1983: 19). Thus, Fleck's theory is inherently based on social and historical context:

Social context: Fleck states that perception is inherently influenced by cultural, social, and academic education, and by the context of the situation in which perception takes place (Fleck 2002: 19). One cannot observe and look at the world in an unbiased and objective way (Schäfer and Schnelle 2002: XXII). Based on these ideas, Fleck emphasises that new ideas cannot be generated by individuals, but only by collective cooperation in a process of social interaction (Schäfer and Schnelle 1983: 19).

Historical context: Perception essentially involves the dimension of historicity. It is a product of a group's long-established activities and, like social organisation, it follows its own guidelines. Pre-ideas can survive over long periods of time, but they can also be further developed by new thought collectives (Schäfer and Schnelle 1983: 19).

Based on the principles of social and historical context, Fleck defines the notions of thought styles and thought collectives as instruments that serve to acquire collective character (Schäfer and Schnelle 1983: 19). In particular, thought style is characterized by common features in the fields of interest of a thought collective, by the judgment which the thought collective considers evident, and by the methods which it applies as a means of cognition (Fleck 2002: 130). The thought collective is described as the carrier of the thought style. It emerges when a group exists long enough so that the thought style becomes fixed and formal in structure (Fleck 2002: 135). Usually, our own thought style appears imperative and other thought styles appear alien to us (Fleck 2002: 185/186). Since perception generally functions unconsciously, it can be said that people are limited by their own thought styles.

Fleck's concept of thought styles and thought collectives is a very adequate instrument for analysing the complex networks of the different actors and actor groups involved in the development of organic agriculture. Inclusion of the social and historical contexts that inherently belong to a scientific process but nevertheless are often neglected by science allows us to go beyond traditionally objective and static approaches. Fleck's theoretical framework allows characterising of scientific as well as non-scientific actor categories, taking account of the interrelationships between the social background of the actors, the social context of interaction, the specific styles of perception, and the different forms of knowledge. Furthermore, Fleck mentions the significance of actors' practical knowledge, which cannot be explicitly formulated (Schäfer and Schnelle 1983: 20). Finally, Fleck's theoretical framework has already been successfully applied to analyse agricultural knowledge production, for example by Fry (2001).

Transdisciplinarity

The field of organic agriculture represents a specific example of multidisciplinary interrelations and perspectives and involves the natural as well as the social system. Thus, the investigation of past and current cases of knowledge production in organic agriculture requires a scientific concept which allows us to address the complexity and uncertainties of the co-evolution of the natural and the social system (Norgaard 1994). Transdisciplinarity is an adequate theoretical framework to support analysis of the forms of knowledge production. From the immense variety of theories, the present research focuses on the following concepts of transdisciplinarity. On the one hand, analysis of the development of organic farming is based on the paradigm of mode 2 knowledge production (Gibbons 1994, Limoges 1996), which means that particularly in a context of application, research is context-driven and focused on problem-solving strategies. Transdisciplinarity means going beyond our normal conceptions of scientific disciplines and trying to integrate and synthesize many different disciplinary perspectives (Costanza et al. 1991). Basically "the core idea of transdisciplinarity is different academic disciplines working jointly with practitioners to solve a real-world problem. It can be applied in a great variety of fields" (Klein et al. 2001). For a more precise identification of the transdisciplinary relationships in organic agriculture, the study additionally relies on the four core principles of transdisciplinarity as defined by Hirsch Hadorn et al. (2008): focus on life-world problems, transcending and integrating of

disciplinary paradigms, participatory research, and the search for unity of knowledge beyond disciplines. Moreover, since worldview and philosophy play an important role in the development of organic agriculture, the notion of strong transdisciplinarity was taken as an additional important reference. Max-Neef's (2005) concept of strong transdisciplinarity breaks with the assumption of a single reality and is based on three pillars. The concept assumes that there are different *levels of reality* that include different, in some cases contradictory laws and fundamental concepts (Nicolescu 2000), for instance quantum physics compared to macrophysics. According to Max-Neef (2005) examples of different reality levels are the physical world, the world of subjective experience and consciousness, or the humanly generated world as language. The *logic of the included middle* overcomes the third axiom of Aristotelian logic, which says that there is nothing that is simultaneously A and non-A. Using the concept of different levels of reality, there might be a state T which unifies two elements that are contradictory on another level of reality (A and non-A). *Complexity* implies that an increasingly complex world with its current problems requires complex thoughts. These aspects of transdisciplinarity are crucial for assessing the different and sometimes contrasting phenomena within the organic movement, as for example philosophical beliefs vs. economic needs.

Concepts of power

Concepts of power represent a very useful theoretical framework for analysis of transdisciplinary knowledge production. The importance of power relations has already been demonstrated by pointing out unequal participation in knowledge production processes in the context of agriculture (Morgan and Murdoch 2000, Derkzen and Bock 2007). There exists a variety of theoretical frameworks of power (e.g. Flyvbjerg 1998, Dowding 2003, Lukes 2005). The concepts of power used in this study are those most suitable for supporting examination of co-production of knowledge in organic agriculture. Generally, power can be described as the opportunity of a person or institution (organisation, group etc.) to control or influence the choices or actions of other persons or institutions. The influence of power can have both negative and positive effects. The classical approach by French and Raven (1959), which was further developed by Raven (1993), forms the basis of numerous additional theoretical power concepts, and distinguishes between five different types of power:

Legitimate (also known as normative) power: Power of persons who are elected (e.g. to a governmental position) or appointed to a superior position (e.g. the leading person of a firm), which gives them the formal authority to prescribe and regulate the behaviour of (groups of) people.

Reward power: Power or ability to confer rewards in different forms that have material value (gifts, promotions), social value (appreciation, recognition), or other benefits.

Coercive power: Power based on being in a position to exert negative influence (degradation, dismissal) or to sanction or punish people who do not comply with one's ideas or demands.

Referent power: Power to attract and gain the loyalty of persons who feel honoured to follow and support the leading person. It is based on the charisma of persons in power, and on the desire of their followers to identify with their attributes and qualities.

Expert power: Power based on possessing distinctive knowledge, expertise, and skills, controlling the information that other people need to achieve their goals. This form of power is restricted to specific areas of knowledge in which persons are experienced and qualified.

These types of power can be considered in various ways in connection with co-production of transdisciplinary knowledge in organic farming. Legitimate power plays a role, for instance, in relation to the recognition of organic products by governmental authorities. The introduction of incentives by the state, or public relations campaigns for retail organic products are forms of reward power. Moreover, the dependence of the recognition of products as ‘organic’ (certification) on compliance with rather rigid guidelines, which includes social and economic sanctions, implies coercive power. Furthermore, the fact that organic farming, especially in its first phase, was strongly influenced by its two founding fathers, Rudolf Steiner and Hans Müller, shows the significance of referent power in the development of organic agriculture. Expert power is attributed to scientists or extension agents who are involved in knowledge production processes in the organic movement. These five types of power are used to analyse, on the one hand, the relationships of power involving actors within the community of organic farming, and on the other hand, relations between actors in organic agriculture and external actors (retailers, policy makers, scientists), and their influence on knowledge co-production.

Institutionalization

In a final step, the present study investigates the influence of institutionalization of the organic movement on knowledge co-production. Since its beginning, the development of organic agriculture has been comparable to a social movement, which we describe as a network of individuals, groups, or organisations engaged in political or cultural issues on the basis of shared collective identity (Della Porta and Diani 2006). In scientific literature, institutionalization has been described with a focus on different aspects, mainly professionalization and on formalization. While professionalization relates to the introduction of paid employees, bureaucratic rules or the takeover of functions by the government (e.g. Staggenborg 1988), formalization is connected to routines, regulations, and norms, but also cognitive factors (Seippel 2001). Both aspects are important for the present thesis, which focuses on interrelationships within the practical, scientific, or political world of organic farming and corresponding norms, routines, and regulations. The present research study defines the notion of institutionalization as “changes in the organisation of the social, political, economical, and/or scientific system from unstructured forms to established and organised structures and/or formal regulations”, following Michelsen (2001) and Seippel (2001).

Research approach and methodologies

Qualitative research methods

The present research study is based on qualitative research methods. I will briefly introduce some aspects of qualitative research, which show that this methodological approach is the most appropriate for the framework of the present research project, which deals with collaborative knowledge production in the development of organic farming. Correspondingly, qualitative methods cannot be regarded independently of the research process and the issues under study. They are embedded in the research process and are best considered from a process-oriented perspective. Before I was able to select the most appropriate research method for my study, I had to gain insight into the field, in my case the world of organic farming in Switzerland. In accordance with Flick (2006) the following features of qualitative research are essential for the present research work: appropriate choice of methods and theories; identification and analysis of different perspectives; and the researcher's reflections on his or her research work as part of the process of knowledge production. An appropriate research method has to be open-ended so that it can do justice to the complexity of the object under study (Flick 2006). It is not the method that determines the study object, but the other way around. Qualitative research inherently includes a variety of perspectives, i.e. the point of view of the researchers, as well as of the participants in the field. These different perspectives are always related to the subjective and social meanings of the subject under study. Qualitative research also involves the study of participants' knowledge and practices. Interrelations between knowledge and participants' practices have to be described in the concrete context of the case and explained in relation to it (Flick 2006). Moreover, qualitative research takes into account the fact that – owing to individual perspectives and social context – viewpoints and practices in the field are different. It was therefore essential for me to gain knowledge of the concerned actors, as for example organic farmers, extension agents and researchers, their backgrounds, and practices. Qualitative research methods also imply that communication between researchers and participants in the study are an explicit part of knowledge production (Flick 2006), which is an essential issue of transdisciplinary knowledge production and a core aspect of the present research work. However, qualitative research is not based on a unified theoretical or methodological concept but depends on the corresponding research project.

The **research process** of the present thesis involved – in an iterative way - the following methodological steps: definition of research questions and aims; sampling process; collection of data; data transcription and coding; data interpretation and evaluation; and presentation of the research findings. However, these steps are interrelated and merge into each other. Moreover, it was important to me that the data and field under study had precedence over theoretical hypotheses. I will now briefly present the single methodological steps in the present research work.

A very important step in the research process is how to define **research aims and questions**. It is crucial to develop a clear idea of the research aims and questions while remaining open to new results. The formulation of the research aim and questions depends on the general thrust of the study, i.e. the identification of thought styles and collectives and the related forms of knowledge production in the development of organic farming in Switzerland; the investigation of power relationships between actors in organic agriculture and how they influence the process of knowledge co-production; and examination of the actors' views and visions of organic agriculture with regard to the future development of knowledge co-production and institutionalization processes. These objectives led to the formulation of the following research questions:

- Can knowledge creation in organic farming be understood in the sense of transdisciplinary knowledge co-production?
- What kinds of thought styles and thought collectives do we find in the development of organic farming?
- What forms of collaborative knowledge production between practitioners, scientists and extension agents occur in the development of organic farming in Switzerland?
- Do power relations play a role in knowledge production processes?
- Does the development of organic farming represent a process of institutionalization?
- What visions and ideas will lead to successful forms of co-production of knowledge with regard to the future development of organic agriculture?

From the various sampling strategies of qualitative research I chose **critical case sampling** (Flick 2006), which is most relevant to the present research work. This sampling strategy involves the selection of critical cases in which the relations to be studied become especially clear. In our study critical cases are the experience and knowledge of pioneer farmers and of representatives of organic agricultural institutions. The major research objective of our study, namely examination of the history of organic farming in Switzerland with regard to transdisciplinary knowledge production, implies a selection of key actors who have specific knowledge about one or several periods of the organic movement and represent one of the investigated actor groups (farmers, scientists, extension agents, policy makers and representatives of organic farming institutions), so that all historical periods and all actor groups are represented by several interviewees.

In order to obtain adequate knowledge of the empirical material, **data collection** was based on a triangulation method using three different qualitative techniques of data collection: **document analysis**, semi-structured interviews, and direct observation and participation. I have analysed literature and research articles on (the history of) organic farming and knowledge exchange between scientists and farmers, historical documents such as organic farming journals (*Demeter* etc.) and other source materials dealing with the organic movement, such as farming instructions. Moreover, I conducted **semi-structured interviews**, including questions referring to the study's specific research objectives, mainly concerning the interviewees' perception of the history and future of organic farming, exchange and interaction with other actors' groups in organic agriculture, the relationship between science,

practice, and extension services, and the influence of external institutions and actor groups on organic farming. Of the eighteen selected interviewees, nine were farmers, five researchers, four extension agents and four were persons engaged in politics (several persons had more than one of these functions). The interviews were introduced with open questions, which generated rather long narratives. I then asked more concrete questions relating to more specific issues. The interviews usually lasted several hours and were digitally recorded. Regarding **direct observation and participation**, it was most interesting to have the chance to get to know about actors' farms and farming techniques directly from the farmers, which gave me most interesting insight in their practices. Also, by attending seminars and workshops together with organic actors, I became aware of how difficult it is to establish cooperation between people and institutions of different backgrounds and fields of interest.

The **data processing** involved transcription and thematic coding of the empirical material (Strauss 1999), since this method implies the underlying assumption that different social groups will manifest different group-specific perspectives (Flick 2002), which is an essential aspect in identification of different thought styles and collectives (Fleck 2002; see below). We defined thematic categories related to our research objectives as a basis for the digital coding process. Then the coded data were grouped into clusters. These clusters have been condensed into the thematic categories, which are represented in the results section below. The subsequent data evaluation and interpretation were supported by the theoretical frameworks of transdisciplinarity, thought styles and thought collectives, concepts of power, and notion of institutionalization, which were applied in different stages of the research and were presented in the preceding section. The interview quotations in the text have been translated from Swiss German into English.

Results

The thesis consists of five scientific articles supplemented by two conference papers on - research results current at the time, which were accepted for peer review, one for presentation (International Sustainability Conference, Basel, 2008) and one as a written conference contribution (ESSHRA Conference, Bern, 2006). Furthermore, the results of the thesis were presented at several scientific meetings (poster presentation at 10. Wissenschaftstagung Ökologischer Landbau, ETH Zürich, 2009; presentations at CDE colloquia 2007 and 2008; and Fleck colloquium at Collegium Helveticum, ETH Zurich, 2009). Three of the scientific articles, all peer-reviewed, have been accepted for publication (two of them are already published and one is in press). The other two have been submitted to scientific journals. I have written all articles and conference papers as first author, co-authored by the supervisor of the thesis, PD Dr. Stephan Rist. The following section presents a short overview of the five scientific articles containing the research results of the present research work.

Article I

Transdisciplinary co-production of knowledge in the development of organic agriculture in Switzerland.

Aeberhard A. and S. Rist. *Ecological Economics* 68: 1171-1181 (2009)

The first article analyses transdisciplinary co-production of knowledge in the development of organic farming in Switzerland by using Fleck's theory of thought styles and thought collectives. Three different phases were distinguished throughout the historical development. The first phase from the 1920s to the early 1970s is characterised by a unique form of cooperation between farmers, extensionists, and researchers. Knowledge was not predominantly generated by scientists and disseminated through extension agents, in the traditional linear manner of knowledge diffusion; on the contrary, knowledge was mainly developed by ecologically committed practitioners or pioneers, supported by scientists of a similar philosophical background. Scientists, farmers and extensionists were a closely collaborating thought collective with a rather common philosophical basis. The second phase is characterised by the formation of the Research Institute of Organic Agriculture in 1974 and of independent extension institutions. This increasing institutionalisation of knowledge production involved a gradual segregation of the thought collectives of farmers, scientists, and extensionists. However, cooperation among them still remained rather close. The third phase since the 1990s shows ambivalent development. The wide acceptance of organic farming on the institutional and societal levels, the rapid growth of the organic market, and the growing influence of ecology on agricultural politics were very positive developments in organic farming. However, these trends at the same time intensified segregation of the thought collectives of practice, extension and research. Moreover, a new thought collective of rather economically motivated farmers emerged, which stood somewhat in contrast to philosophically oriented thought collectives. This gradual disintegration of the diverse thought collectives provoked a decrease in the exchange between science and farmers and a loss of the corresponding innovation potential.

The results demonstrate that the development of organic agriculture in Switzerland shows relatively successful processes of co-producing knowledge throughout the course of its history, although organic agriculture did not explicitly rely on the principles of transdisciplinarity. This aspect has not been perceived as such in past and present scientific discussions.

The various forms of transdisciplinary research in the first and second phases, like the ‘Möschberg’ meetings or joint planning of research projects, have disappeared. Research has increasingly been based on natural science and economics, and the philosophical visions present in the previous phases of the organic movement were marginalised. Thus, the price for positive societal recognition is associated with the gradual loss of its very valuable forms of knowledge co-production and the related philosophical background. The article emphasizes that implicitly occurring very valuable forms of transdisciplinary knowledge production should be reflected on, investigated, and institutionalized in order to strategically re-establish or maintain them with regard to a successful further development of collaborative knowledge production in organic agriculture.

Article II

Power and Knowledge Co-Production – A Case Study of the Development of Organic Agriculture in Switzerland.

Aeberhard A. and S. Rist. Submitted to *Ecology&Society* [in review].

Article II examines whether and in what way power relations play a role in the ambiguous development of societal recognition and the decrease of collaborative knowledge creation in organic farming. It analyses the three phases of knowledge co-production and corresponding power distribution as well as its enabling or hindering influence on collaborative knowledge creation. The results reveal that different forms of power are apparent in the history of organic farming. It was shown that there has been a significant shift from a situation where important power relations appear within the organic movement towards a distinct asymmetry of power relations between the organic community and related external actors such as retailers, policy makers, and scientists. The power impact of actors outside organic agriculture has a predominantly inhibiting influence on joint knowledge production. For example, the power of governmental incentives or retail trade companies and consumers, respectively, has provoked a shift of farmers’ interests in the philosophical elements of organic farming to more economic ways of thinking, and thus diminished farmers’ commitment to knowledge creation. An important power imbalance emerging in the later phase was a shift of expert power from farmers and organic scientific institutions to traditionally specialised agricultural research institutes. Holistic approaches, which focus on the interrelation of natural processes, have been replaced by specialised knowledge, which creates a dependence of farmers on scientific specialists. The great increase of external power influences in the third phase was identified as an important reason for the decreasing intensity of transdisciplinary knowledge creation. Moreover, the results show that some forms of power may enable collaborative knowledge production and at the same time hinder it, depending on how it is constituted. For example, a powerful leader strongly supported collaborative knowledge creation and enabled knowledge

exchange between actors in organic farming in the initial phase, but hindered knowledge exchange in the later phases by becoming dogmatic and suppressing all ideas that conflicted with his own ideas. The article suggests that in order to re-establish previously implicitly applied transdisciplinary knowledge production, a better balance of power relations between the core actors in organic agriculture, and especially between members of the organic movement and external actors and institutions is required, and that research on organic farming should rely on more participatory forms of knowledge production.

Article III

The influence of institutionalization on collaborative knowledge production and in the development of organic farming in Switzerland

Aeberhard A. and S. Rist, 2009. Submitted to *Journal of Rural Studies*.

Article III analyses the process of institutionalization of the organic movement and its influence on knowledge co-production in the future development of organic farming. The history of organic farming is comparable to the evolution of a social movement that involves societal and political recognition and corresponding institutionalization processes on the one hand, and - along with this - the loss of some of its original ideas on the other. These processes have been observed in organic agriculture in other countries, and in environmental movements in general. The views and visions of the key actors interviewed about the current situation reveal that although institutionalization is basically a positive development and constitutes a success, it has nevertheless meant a loss of collaboration in knowledge co-production between the different actors in organic farming. At the same time, growing conventionalization in organic agriculture has been observed, which leads to a loss of sustainability. The actors interviewed were concerned about the decrease of knowledge exchange and the decline of original ideas and philosophies. Based on critical investigation, the article recommends that –initially active joint knowledge creation should be re-intensified by means of concepts of transdisciplinarity. However, this must be done in a way that suits the context of today's institutional framework conditions, which is quite different from the early phase of organic farming.

Article IV

Transdisziplinäre Wissensproduktion im Biolandbau.

Aeberhard A. and S. Rist. *Agrarforschung* [in press, forthcoming October 2009].

Article IV focuses on (interviewed) actors' views and visions of the future development of organic farming and analyses these ideas in relation to transdisciplinary knowledge co-production. The results show that the key actors' visions focus on four main topics: firstly, dealing with the basic principles and ideas of organic farming has high significance. A decline in the importance of these principles and an increasing orientation towards conventional agriculture is considered a weakening of the organic idea and constitutes a gradual loss of the benefits of organic farming. Secondly, better inclusion of experiential knowledge in research is seen as very important for the future development of organic agriculture. Funding agencies are being invited to increase their funding of problem-oriented and transdisciplinary research,

which focuses on applicability and system interrelations. Thirdly, regarding the political and economical levels, the actors in the study requested long-term and sustainable agricultural planning. Optimal use of resources – soil as well as plants and animals – is preferable to short-term yield maximization, as for example with high-performance cows. Fourthly, actors believe relative independence with regard to production to be important. Intensified marketing, which highlights the variety of advantages of organic food, should improve, and ensure that consumers pay adequate prices that allow farmers to survive economically and sustain natural food production. The data show that actors are aware of the problem of decreasing knowledge production and wish to re-enforce previous intensive collaboration. Besides inclusion of experiential knowledge and research funding, the actors' main concerns were also related to other important factors identified in the previous articles as influencing knowledge co-production, namely the importance of basic principles and the influence of external power. Other research has shown that joint production of knowledge is indeed crucial for the solution of sustainability problems and thus confirms the importance of the actors' requests. A good instrument to achieve this goal would be reflection on transdisciplinary concepts and a corresponding formalization of mutual knowledge production on an institutional level in order to provide a platform for joint knowledge generation between actors in different fields of organic agriculture, such as practice, science or policy.

Article V

Koproduktion von Wissen in der Entwicklung des Biolandbaus - Einflüsse von Marginalisierung, Anerkennung und Markt.

Aeberhard A. and S. Rist, 2009. In: Mayer, J et al. (Hrsg.), Werte – Wege – Wirkungen: Biolandbau im Spannungsfeld zwischen Ernährungssicherung, Markt und Klimawandel. Beiträge zur 10. Wissenschaftstagung Ökologischer Landbau, Zürich, 11.-13. Februar 2009 (vol 1). Berlin, Dr. Köster Verlag, (<http://orgprints.org/14377/>).

Article V is based on the research findings presented in article I. Empirical analysis of the historical development of transdisciplinary co-production of knowledge in organic agriculture in Switzerland reveals three distinct phases. The organic movement emerged as a reaction to the increasing industrialization of agriculture and was for a long time rather an outsider movement, not considered and accepted by society and policy, and even rejected by conventional agriculture. This marginalization has led to strong internal coherence among the pioneers (practitioners, scientists and extension agents) of the organic movement, and in turn to intensive joint knowledge production, for example, regarding the development of suitable soil cultivation methods. The later phases involve a decrease in joint knowledge creation, caused by internal and mainly external impacts, such as the foundation of independent research institutions, changes in agriculture policy, and new market strategies. To reverse this trend, it would be important to institutionalize the involvement of concerned actors in knowledge generation processes, such as participation on the scientific or political level.

Synthesis and conclusions

Identification and analysis of the different thought styles and thought collectives of the actors in organic agriculture forms a solid basis for the characterization and comparison of the different knowledge systems of farmers, scientists, and extension agents, including consideration of their specific social, historical, philosophical, and epistemological backgrounds. The study shows that there is a clear evolution in the history of organic farming, which went from being an outsider movement in its initial phase to becoming a broad farmer community practising an ecological and sustainable form of agriculture that is currently well-established and acknowledged in policy and society. During the course of this development, various forms of transdisciplinary knowledge production were lost so that the intensity of joint knowledge creation between actors in the organic community has gradually decreased. This development has partly been triggered by increasing processes of institutionalization in organic farming, especially with regard to scientific research, certification processes, and market expansion. The initially successful examples of collaborative knowledge production, which are in accordance with numerous characteristics of diverse, well-established definitions and concepts of current scientific notions of transdisciplinarity - however unknowingly applied by organic pioneers - were favoured by particular circumstances, namely a common ideological motivation among diverse kinds of thought collectives and the need to find rapid solutions to problems unnoticed until that time. In discussions on this issue within scientific circles the question arose whether co-production of knowledge at the beginning of organic farming corresponded to transdisciplinary criteria or not, because science had not yet been institutionalized at that time, and thus does — not represent an adequate concerned actor group in the sense of the critical voices. I respond to this point in a twofold way. On the one hand, as the literature and interviews show, scientists, in fields such as microbiology, medicine, botany, or agronomy were present from the very beginning of the organic movement. They were committed to finding organic alternatives to industrialized agriculture and food production, but were hardly visible since they were marginalized by mainstream science. On the other hand, the concept of transdisciplinarity used in the present research is based on diverse, well-established definitions of transdisciplinarity, as described in the section on theoretical frameworks in this thesis, which do not assume that science has to be institutionalized. According to these definitions, collaboration between scientists, practitioners, and extension agents can be well described as a transdisciplinary mode of knowledge production.

Furthermore, the results of this research show that the development of organic farming involves processes of institutionalization of a social movement, a not uncommon process that has been widely discussed, especially in the field of environmental movements (e.g. Brand 1999, Coglianese 2001, Seippel 2001, Doyle 2005). An interesting issue concerning the institutionalization process in organic farming is that it represents, on the one hand, a positive consequence of the original initiatives and efforts to establish organic principles made by organic pioneers. On the other hand, it has led to new institutional structures, which involve new forms of control that can have inhibiting impacts on the routines and ideas that were

successful in the initial phase of organic agriculture. Moreover, this thesis has revealed that at the same time the intensity of knowledge co-production has decreased. Thus, the loss of the philosophy and the processes through which solutions were elaborated seems to be the price of significant societal recognition. Several scientific studies describe this professionalization and formalization process (e.g. Seippel 2001, Michelsen 2001), and similar dilemmas have been observed in other countries such as Denmark (Kaltoft 2001, Michelsen 2001), Germany (Gerber et al. 1996, Lehmann 2005), Ireland (Tovey 1997), or Australia and New Zealand (Lyons and Lawrence 1999).

Here, the question could be raised, whether the institutionalization of the organic movement does not represent the normal development of an innovation, and whether growing societal, economic and political recognition represents a satisfying form of success that requires no investigation of its further development. I see two major reasons for emphasizing the necessity to further examine the present situation concerning the interrelationships of concerned actors of organic agriculture. Firstly, analysis of the interviews shows that committed actors in the organic community are concerned about the fact that collaborative knowledge production, in particular between science and practice, has decreased, and that the initial pioneer attitude is no longer as pronounced. Indeed, previous research findings confirm that joint knowledge production between practice and science is essential for the solution of sustainability problems (Grunwald 2004, Cash et al. 2006, Luks und Siebenhüner 2007) and is also crucial for the further development of organic farming (Gerber et al. 1996). This also shows that from a scientific point of view it is appropriate to consider the ideas and concerns of the actors interviewed. Secondly, the results of the research have shown that the decrease in intensity of joint knowledge production, as well as of the importance of the original principles of the organic movement, has led to the progressive conventionalization of organic farming and thus to a decline in its sustainability, which is closely related to fundamental ideas such as a holistic view of the agricultural system.

However, we do not suggest returning to the 'old days' of the initial phase of organic agriculture, but propose that the members of the organic movement should reflect on the role of transdisciplinarity and the possibilities of implementing it in the present and future development of organic farming, which would be a most adequate instrument for reversing the development described above. Transdisciplinarity involves consideration of different perspectives and knowledge systems and therefore can respond to visions regarding the desired re-examination of the principles and original ideas of the movement. The development of strategies for establishing successful forms of transdisciplinary knowledge production is crucial for the future development of organic farming, but has been neglected up to now. Due to the lack of contact between scientists and practitioners it became increasingly difficult to develop methods suitable for implementing new findings in practice. One important strategy is to intensify mutual recognition among the involved actors, be they from academic or non-academic fields, and understanding of the corresponding different thought styles. This requires a strong commitment among actors in science, practice, policy and the market. Intensification of the integration of practical knowledge could be supported by the implementation of transdisciplinary research projects. Here, for example, required steps

include the formation of interdisciplinary project teams in the fields of economics, ecology, the natural and social sciences, a search for partners in practice, task-sharing among project partners, and the quest for a common language (Hoffmann et al. 2009). In this sense, by reflecting on the processes of transdisciplinary creation of knowledge throughout its history, a forgotten element of the success story of organic farming can be valorized again in a new institutional context, and thus be linked to the approaches that see transdisciplinary knowledge production as the basis for forward sustainable development.

Furthermore, the thesis revealed that the shift in power relations from internal control (within the organic farming community) to external determination is an important factor that influences the development of knowledge co-production in organic agriculture. Today, the initially high degree of joint knowledge co-production in the development of organic agriculture is endangered because the organic movement has increasingly lost internal control relating to the different power types. At the same time, organic agriculture is increasingly dominated by the externally constituted power influence of policy-makers, retail traders and institutions concerned with research and certification. It has been shown that mainly the asymmetry of expert power, which with the increasing importance of specialised, formalised, or abstract knowledge is rather allocated to conventional science, inhibits collaboration in knowledge production. Thus, when considering the re-intensification of transdisciplinary knowledge production, power relations have to be taken into account, since the great increase of external power control in the third phase is a very important reason for the decreasing intensity of collaborative knowledge co-production. However, it will be challenging to provoke a change in these power imbalances, since most organic farmers today depend on external support in one or way or another, be it incentives, supply contracts, or market demands. However, there are some options for re-establishing more equal power relations in the present situation of organic agriculture. Research relating to the further development of organic agriculture should shift from overemphasizing sectoral or rather isolated problems that tend to represent the interests of external actors, to a transdisciplinary approach of knowledge co-production. This implies that the process of defining research topics requires consideration of the perspectives, roles, and responsibilities of farmers on the one hand, and scientists, policy-makers, consumers and retailers on the other hand, by following the principles of transdisciplinary research approach. This means, for example, interdisciplinary research methods, the integration of academic and non-academic knowledge and actors, and joint collective action. It is therefore necessary to convince external actors and institutions involved in organic farming to rely on co-management, including more participatory and democratic forms of knowledge production. In this way, knowledge production in organic agriculture could be put on a new basis, which would help to overcome imbalanced power relations and to reconsider and restructure the networks of organic agriculture in accordance with the principles of transdisciplinarity.

Is it possible to draw conclusions from this thesis for other fields? Normally, the development of knowledge production moves in a direction opposite that observed in organic farming: it leads from unidirectional knowledge transfer towards knowledge sharing and interfacing (Roux et al., 2006). Most often, transdisciplinary research is initiated externally and driven by

the insight that this kind of research leads to improved applicability, acceptance concerning implementation, and more sustainable ways of problem-solving (Rist and Wiesmann 2003, Wiesmann et al. 2008, Hoffmann et al. 2009). However, many of the forms of joint knowledge creation in organic farming can offer important advice and give stimulus to the development of basic concepts of collaborative production of knowledge in other areas of sustainability science. Reconstruction of the original strengths of organic agriculture in co-producing knowledge on the level of today's institutional framework conditions would be an essential step towards more ecological and sustainable forms of agriculture in the future.

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Article I

**Transdisciplinary co-production of knowledge in the
development of organic agriculture in Switzerland**

Image: Organic farming course by Mina Hofstetter (source: Maurmer Post)



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ANALYSIS

Transdisciplinary co-production of knowledge in the development of organic agriculture in Switzerland

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ABSTRACT

The present study analyses transdisciplinary co-production of knowledge in the development of organic farming in Switzerland by using Fleck's theory of thought styles and thought collectives. Three different phases can be identified throughout the historical development. The initial phase lasting from the beginning of the 1920s to the early 1970s contains numerous characteristics of diverse well-established definitions and concepts of transdisciplinarity and represents a successful transdisciplinary process, which has not been perceived as such in the past and present scientific discussion. The second and third phases show an increasing segregation of thought collectives, caused by internal changes such as the establishment of specialised research institutions and external processes like agriculture policy and market development. These developments led to a decreasing degree of transdisciplinarity. We observe an ambiguous trend: the continuously growing and today well-established positive societal recognition of an initially rather little accepted newcomer movement is associated with the gradual loss of its very valuable forms of knowledge co-production and the related philosophical background. In order to maintain the various forms of transdisciplinary co-production of knowledge, one has to reflect not only their results or outcome but also the whole cooperation process, which has led to these results. The understanding of the historical development and characteristic features of knowledge co-production as presented in this study will help to reinforce transdisciplinary research in organic agriculture and research on transdisciplinarity in general.

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1. Introduction

Ecological economics involves transdisciplinary relations to address the complexity and uncertainties of the co-evolution of the natural and the social system (Norgaard, 1994). Agriculture links the natural and social system and thus includes a number of complex and transdisciplinary interrelations. In this sense, transdisciplinary co-production of knowledge in organic agriculture, which is the major issue of the present

study, represents a specific example of multidisciplinary interrelations. A growing number of scientific publications relating to research on sustainable development conclude that knowledge generated in science and society has become increasingly interdependent (Elzinga, 1997; Grunwald 2004; Jasanoff, 2004). As a consequence, the science–society–policy relationship is understood as the outcome of a process of co-production of knowledge through which actors affirm their identities and the legitimacy of their claims and practices (Luks

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and Siebenhüner, 2007). A transdisciplinary mode of knowledge co-production implies that problem solving strategies have to be based on a close interaction between scientists and other involved actors, whereby it overcomes the pitfalls of a one-dimensional and linear interconnection between science and society, which neglects to address concepts of complexity and plurality. Therefore, the analysis of current and past cases of knowledge production attains fundamental importance to further projects of research and practice in the field of sustainable development.

Today the advantages and benefits of organic agriculture, which have been described for example by Mäder et al. (2002) or Macilwain (2004) are rather well-known in Switzerland. As found by Wheeler (2008), people's estimation of organic farming is enhanced by increased knowledge about it. Organic agriculture nowadays is well accepted in governmental and scientific institutions, and organic products are highly appreciated by consumers.

Seen against this background the development of organic agriculture in Switzerland sets a rather successful example showing processes of co-producing knowledge throughout the course of its history. Although organic agriculture did not explicitly rely on the principles of knowledge co-production and transdisciplinarity, its evolution is characterised by a unique form of cooperation between farmers, extension agents, and researchers. Thus, knowledge co-production in organic farming represents many basic features of transdisciplinarity (Rist and Wiesmann, 2003; Vogl and Vogl-Lukasser, 2003) and therefore seems to be a successful example of—implicitly applied—transdisciplinary interaction. This aspect has not been perceived as such in the past and present scientific discussion. While the historical development of organic agriculture is attended in several scientific studies (Koepf and von Plato, 2001; Vogt, 2001; Schaumann et al., 2002) a systematic analysis of the interrelationships between practitioners, researchers and extension agents in organic agriculture in Switzerland has been neglected up to present. For these reasons, the present study analyses the development of organic farming with focus on the (extent of) co-production of knowledge and its relation to principles of transdisciplinarity.¹ With this analysis we intend to contribute on an empirical basis to the debates about fundamental conditions, potentials and shortcomings of co-production of knowledge. Moreover, the present study offers a conceptual and empirical framework to which the community supporting organic agriculture could relate more systematically in future. This includes the high potential of internal innovations of the organic movement and a contribution to the emerging field of innovative re-conceptualizations of the relationship between science and society.

The aims of the study are represented in three steps. The first step is to assess the historical development of organic farming in Switzerland with focus on co-production of knowledge. In a second step the different *thought styles* and *thought collectives* of the actors in the development of organic farming are identified in the line of Fleck's (2002) corresponding theory. Based on these steps the final section involves the analysis of

the transdisciplinary co-production of knowledge between actors in farming, extension services and research.

2. Methodological and theoretical framework

2.1. Qualitative research methods

The present study is based on qualitative research methods. The sampling process of our research work involves critical case sampling (Flick, 2006), entailing the selection of critical cases in which the relations to be studied become especially clear. In our study critical cases are the experience and knowledge of pioneer farmers and of representatives of organic agriculture institutions. The major research objective of our study, namely the examination of the history of organic farming in Switzerland with regard to transdisciplinary knowledge production, implies a selection of key actors who have specific knowledge about one or several periods of the organic movement and represent one of the investigated actor groups (farmers, scientists, extension agents), so that all historical periods and all actor groups are addressed by several interviewees.

The data collection is based on document analysis and semi-structured interviews. We have analysed articles, historical documents and source materials originating from different perspectives dealing with the organic movement. Furthermore, we have defined semi-structured interview guidelines including questions referring to our specific research objectives, mainly concerning the interviewees' perception of the history of organic farming, the exchange and interaction with other actors groups in organic agriculture, or the relationship between science, practice and extension service. We began the interviews with open questions, which generated rather long narratives. Then, we asked more concrete questions relating to more specific issues. The interviews have been recorded.

The data processing involved transcription and thematic coding (Strauss, 1999), since this method implies the underlying assumption that different social groups will manifest different group-specific perspectives (Flick, 2006) which is an essential aspect regarding the identification of different thought styles and collectives (Fleck 2002; see below). Relating to each of our research objectives, we defined thematic categories, which were the basis for the coding process. Then, the coded data has been evaluated.

The data evaluation and interpretation were supported by the theoretical frameworks (transdisciplinarity and thought styles and collectives) presented below.

2.2. Transdisciplinarity

Transdisciplinarity plays an important role in the development of knowledge production in organic farming. Below, we show where we position our understanding of transdisciplinarity within the immense variety of theories.

On the one hand, the analysis of the development of organic farming is based on the paradigm of mode 2 knowledge production (Gibbons et al., 2005; Limoges, 1996), which means that particularly in a context of application, research is context driven and focused on problem solving strategies. In general, we share the notion of transdisciplinarity as used in

¹ We emphasize that transdisciplinarity is not the methodological framework but a research object of the present study.

the field of ecological economics: “By transdisciplinarity we mean that ecological economics goes beyond our normal conceptions of scientific disciplines and tries to integrate and synthesize many different disciplinary perspectives” (Costanza et al., 1991, p. 3). Basically “the core idea of transdisciplinarity is different academic disciplines working jointly with practitioners to solve a real-world problem. It can be applied in a great variety of fields” (Klein et al., 2001, p. 4). For a more precise identification of the transdisciplinary relationships in organic agriculture, we additionally rely on the four core principles of transdisciplinarity as defined by Hirsch Hadorn et al. (2007): focus on life-world problems, transcending and integrating of disciplinary paradigms, participatory research, and the search for unity of knowledge beyond disciplines.

Since worldview and philosophy play an important role in the development of organic agriculture, the notion of strong transdisciplinarity was taken as an additional important reference. Max-Neef's (2005) concept of strong transdisciplinarity breaks with the assumption of a single reality and is based on three pillars:

Levels of reality: The concept assumes that there are different levels of reality that include different, in some cases contradictory laws and fundamental concepts (Nicolescu, 2000), for instance quantum physics compared to macro-physics. According to Max-Neef (2005) examples of different reality levels are the physical world, the world of subjective experience and consciousness or the humanly generated world as language.

The *logic of the included middle* overcomes the third axiom of the Aristotelian logic² which says that there is nothing, that is simultaneously A and non-A. Using the concept of different levels of reality, there might be a state T which unifies two elements, that are contradictory on another level of reality (A and non-A).

Complexity implies that an increasingly complex world with its current problems requires complex thoughts.

These aspects are crucial for combining the diverse elements of organic agriculture, as for example the philosophical principles and the economic needs of farmers.

2.3. Thought styles and thought collectives

An excellent theoretical framework to compare different knowledge systems which have been generated, developed and (re-)conceptualised in the development of organic farming are the classical concepts of thought styles and thought collectives introduced by the Polish microbiologist and physician Ludwik Fleck. Fleck defines the notions of thought styles and thought collectives as historically developed, sociologically determined and interrelated phenomena, which are continually evolving mostly without the consciousness of the concerned actors (Schäfer and Schnelle, 1983, p. 19). Thus,

² The three fundamental axioms of the linear logic of Aristotelian tradition are: 1. The axiom of identity: A is A. 2. The axiom of non contradiction: A is not non-A. 3. The axiom of the excluded middle. There exists no third term T, that is simultaneously A and non-A.

Fleck's theory is inherently based on social and historical context:

- **Social context:** Fleck states that perception is inherently influenced by cultural, social and academic education and by the context of the perception situation (Fleck, 2002, p. 19). One cannot observe and look at the world in an unbiased and objective way (Schäfer and Schnelle, 2002, p. XXII). Based on these ideas, Fleck emphasises that new ideas cannot be generated by individuals, but only by a collective cooperation in a process of social interaction (Schäfer and Schnelle, 1983, p. 19).
- **Historical context:** Perception essentially involves the dimension of historicity. It is a product of a group's long-living activities and follows—like social organisation—its own guidelines. Pre-ideas can survive over long periods of time, but they can also be further developed by new thought collectives (Schäfer and Schnelle, 1983, p. 19).

Based on the principles of social and historical context, Fleck defines the notions of thought styles and thought collectives as instruments, which serve to acquire collective character (Schäfer and Schnelle, 1983, p. 19). In particular, thought style is characterized by common features in the fields of interest to a thought collective, by the judgment, which the thought collective considers evident and by the methods, which it applies as a means of cognition (Fleck, 2002, p. 130). The thought collective is described as the carrier of the thought style. It emerges when a group exists long enough so that the thought style becomes fixed and formal in structure (Fleck, 2002, p. 135). Mostly, the own thought style appears imperative and other thought styles appear alien to us (Fleck, 2002, pp. 185/186). Since generally perception functions unconsciously, it can be said that people are limited by their own thought styles.

Fleck's concept of thought styles and thought collectives is a most adequate instrument to analyse the complex networks of the different actors and actor groups involved in the development of organic agriculture. The inclusion of social and historical context, which inherently belong to a scientific process but nevertheless are often neglected by science, allows going beyond traditionally objective and static approaches. Fleck's theoretical framework allows characterising scientific as well as non-scientific actor categories, taking account of the interrelationships between the social background of the actors, the social context of interaction, the specific styles of perception and the different forms of knowledge. Furthermore, Fleck mentions the significance of the actors' practical knowledge, which cannot be explicitly formulated (Schäfer and Schnelle, 1983, p. 20). Fleck's theoretical framework already has been successfully applied to analyse agricultural knowledge production (Fry, 2001).

3. Milestones of organic farming in Switzerland

This section gives a short overview of the history of organic farming in Switzerland. The first ideas about organic farming evolved from concerns about the changing interrelations of

man and nature as reflected in modern technology (Michelsen, 2001) and the emerging technological problems resulting from industrial production modes. After the First World War signs of first ecological damages like soil compaction or decreasing food quality have emerged. Therefore, some farmers as well as agronomic scientists were looking for alternatives. In 1924 Rudolf Steiner presented in a course the basic ideas of bio-dynamic farming which is based on elements of anthroposophical philosophy,³ ethics, traditional farming methods and scientific, mainly agronomic knowledge. These rather programmatic ideas were implemented and tested by interested farmers and researchers (Schaumann et al., 2002, p. 29). In these times, knowledge was exchanged through lectures given by farmers, courses held by pioneers, and the journal "Demeter—monthly newsletter for bio-dynamic cultivation". From 1930 up to present bio-dynamic associations and products have been labelled "Demeter".

After the Second World War a second concept, bio-organic farming, emerged. It was promoted by a political organisation, the "Jungbauern" (so-called young farmers), and the Swiss Farmers' Homeland Organisation directed by Hans Müller. This group of farmers founded an associative cultivation and marketing organisation ("AVG Galmiz"). They gradually introduced organic farming, mainly because organic products showed higher food and storing qualities (Moser, 1994, p. 334). Because some of the anthroposophical ideas were not in line with the Christian belief or seemed too complex, they developed an own concept, mainly based on the cycle of living substance of the microbiologist Hans Peter Rusch (1952). However, they kept some aspects of bio-dynamic farming. Based on experience gained by their everyday work the farmers developed individual ecological cultivation practices (Vogt, 2001, p. 48). Self-controlled on-farm research of practitioners was a main resource of innovation. Information exchange was coordinated by the Farmer Homeland School Mösberg and the journal "Kultur und Politik". Already in 1958, Migros, one of the market leaders in retail trade, started to sell organic products and thus provided an important specific market for organic farmers (Moser, 1994, p. 334).

At the beginning of the 1970s attempts to establish research on organic farming within the official agronomic research institutions and to attain recognition on the political level have not been successful. Politicians and many researchers rejected these initiatives pointing to the supposedly unscientific fundament of organic agriculture. Thus, in 1973 the "Swiss foundation for the advancement of biological land cultivation" was founded on a private basis. One year later the foundation initiated the Research Institute for Biological agriculture (FiBL). The FiBL mainly tried to improve the methods of organic farming with regard to technical, ecological and economic purposes. Due to the ongoing governmental dismissal of organic farming, in 1980 the major cultivation associations

agreed on general cultivation guidelines and a joint trademark (Bud label) for organic products. In 1982 they founded the association of Swiss organic farming organisations "BIO SUISSE", which established an independent system of certification of all organic farmers in Switzerland. The scientific work of the FiBL lead to a rapid increase of the recognition of organic agriculture in civil society and public organizations.

Besides the bio-dynamic and bio-organic movement another area of organic agriculture has emerged which relies on the scientifically based aspects of the two established forms of organic farming and adopted a style which we sum up as ecological farming. In the 1980s and 1990s, ecological farming mainly focussed on topics like ecology, protection of the environment, species-appropriate livestock farming, and sustainability (Vogt, 2001, p. 47). In the 1990s Coop, the second retail trade leader in Switzerland, started selling organic products on a broad basis, and Migros followed by expanding its corresponding efforts. In addition, the government adopted the production guidelines of organic agriculture as part of a law. This official recognition allowed also providing direct governmental incentives for ecological services provided by organic farmers. Based on these developments farmers were increasingly motivated to switch to organic farming for economic reasons. Therefore, the group of "ecological farmers" was growing much faster than the one of bio-organic or bio-dynamic farming. The philosophical dimension of organic farming was slowly losing importance. Also the meetings of practitioners, extension agents and scientists were less frequent. A long-term experiment was started to compare the effects of conventional and organic agriculture on food quality and sustainability (Dubois et al., 2003).

In some other European countries, several characteristics in the development of organic farming are similar to the observed processes in Switzerland. Organic agriculture in its origin has been part of an international, mainly European-based, development involving important initiatives in Germany and Austria (Vogl and Darnhofer, 2004), France (Reynaud, 1998), or United Kingdom (Koepf and von Plato, 2001). In Austria organic farming has begun in the 1920s influenced by Rudolf Steiner. Organic farming cooperations have been established in the 1960s, a research institute has been founded in 1980, production standards were defined in the early 1980s, and in the 1990s supermarkets enhanced the selling of organic products. The first government support schemes generated an increase of the number of organic farms from about 2000 in 1991 to 6000 in 1992 (Vogl and Darnhofer 2004). In Germany, a research institute for bio-dynamic agriculture has already been established in 1950 (Vogt 2000). The development of knowledge production in these countries has not been extensively analysed up to now, but due to similar developments and circumstances comparable trends can be expected. Further analysis of this topic would be highly illuminating.

In further European countries, like in Denmark, there was also a movement from a rather small community of pioneer farmers to a broadly institutionalized organic food system, with supermarkets expanding the sale in the 1990s. However, in Denmark organic farms have not started to emerge until the 1970s, and the development ran faster than in Switzerland (Ingemann 2006). In these countries, pioneers could borrow knowledge developed in German speaking countries.

³ Anthroposophy is a philosophy introduced by Rudolf Steiner (1861–1925), which assumes a comprehensible spiritual world that transcends the scientific and the common mystic world. Anthroposophy proposes ways to experience and explore this transcendental world. Anthroposophical ideas have been practically applied for instance in organic agriculture and anthroposophical medicine.

4. Different thought styles and thought collectives in the development of organic farming

The examination of the historical development of organic farming and the evaluation of the interviews with various key actors of the past and recent history of organic agriculture suggest distinguishing the thought styles of farmers, scientists and extension agents and the thought styles concerning the different organic movements, i.e. bio-dynamic, bio-organic, and ecological farming. These different thought styles are described below and the corresponding characteristics are summarized in Tables 1 and 2 respectively.

4.1. Thought style of farmers

The analysis of the thought style of the actors relating to practice, predominantly farmers, shows that they emphasise on experiential knowledge. In comparison to scientists and researchers who rather concentrate on how or why something happens, for farmers it is primarily important that a specific farming method works. While scientists are more oriented towards processes, which generate outcome, farmers generally focus on conditions leading to successful results. If there

Table 1 – The bio-dynamic, bio-organic and ecological thought styles

Characteristics of thought style	
Bio-dynamic	Anthroposophical philosophy Holistic view of farm as an individual organism Use of specific preparations containing non-physical forces Disease is tackled as a problem of the whole farm organism Consideration of astronomical influences (moon and planets) Personal relationship to nature Contribution to the evolution of mankind and nature Production of healthy food
Bio-organic	Based on theory of “cycle of living substance” Conservation of farming traditions and life style Pragmatic solutions for social, ecological, political, and economical problems Production of high quality food Better suitability of food storage High importance of life in soils and soil protection Aerobic manure preparation and organic fertilizers Christian faith
Ecological	Sustainable and ecological way of farming No use of synthetic means Concept of ecosystem theory (flows of substance and energies) Crop rotation, animal manures and mechanical cultivation Maintenance of soil productivity Sustain and enhance the health of ecosystems and organisms Based on science and research High quality products /specialities achieving higher prices Market-oriented, address market niches Economical integration

Table 2 – Thought styles of practice, extension and science

Characteristics of thought style	
Practice	Priority of practical and experiential knowledge Integration of local and scientific knowledge Relations between own actions and nature (e.g. weather, soil characteristics, plant growth) Focus on the outcome of processes Interest in production of goods and services Qualitative observations Production of goods Important is that a method works
Research/science	Scientific knowledge Quantitative observations and measurements Chemical, physical or biological methods Innovation of new methods and knowledge Important is how or why a method works
Extension	Combination of and exchange between scientific and farmers' knowledge Support of farmers Communication of scientific findings

is a positive result, farmers are willing to use a certain farming method and to accept the underlying scientific or philosophical explanation. Although the practical aspect is the main reference for farmers, their decisions, whether joining one of the different organic movements or not, cannot be reduced to considerations concerning practical outcome. On the contrary, due to the importance of underlying philosophy of organic farming to some farmers, they rely upon some kind of practical philosophy of farming. They aim at enhancing the changing body of practical knowledge, which is linked to equally changing normative and philosophical bases.

The following statement of a farmer woman describes in which way her farming methods relate to a certain philosophy of life: “People always say that our strawberries have a different taste than conventional ones. When planting strawberries, conventional farmers use sheeting that cover the soil. We were hacking up the soil so that it can live. We did not cover our strawberry plants so that they could absorb substances from the air and the soil. I do not know the influence of sheeting to the soil, maybe it is even harmful” (interview with a farmer woman, 2007, translated from Swiss German). This citation explains certain methods of organic soil preparation and shows that environmental concern and the comprehension of the soil as living entity are central elements of a practical philosophy.

Most of the farmers (but also scientists or extension agents) can be assigned to either the bio-dynamic, bio-organic or the ecological thought style. Below, the main characteristics of these three thought styles are described (see Table 1).

The *bio-dynamic* thought style is based on the anthroposophical ideas of Rudolf Steiner. Steiner sees nature as a holistic system and tenant of all natural powers. These powers are important for food production and have to be taken into account to produce healthy food. In this sense, industrial agriculture is seen as a depletion of the power of nature. Farmers believe in the added value (e.g. higher nutrition content etc.) of ecologic and organic products. Moreover, in the anthroposophical view each farm is seen as a closed self-

nourishing system with its specific characteristics and specific interaction of humans, plants, animals, soil, nutrients, etc. The work and perception of an actor is linked through the personal relationship to nature. In this sense, disease of an organism should not be tackled in isolation but as a symptom of problems in the whole farm and the corresponding activities. As far as possible, all necessary materials such as manure etc. should be produced on the farm. A characteristic method of bio-dynamic farming is the use of so-called preparations (broths or compounds of natural materials), which have been produced on the farm in specific ways to engage non-physical beings and elemental forces. Planting and harvesting is effected in relation to the movement patterns of the moon and planets. These characteristics represent a major difference to other organic farming concepts.

The *bio-organic* thought style does not include the esoteric parts of bio-dynamic farming. Its founder, Hans Müller, was looking for pragmatic solutions with regard to social, ecological, political and economical problems. As a basis he adopted the concept of nature as a cycle of living substance defined by H.P. Rusch (1952). Müller believed that many farmers would better understand and accept Rusch's concept than the anthroposophical philosophy. In contrast to the bio-dynamic philosophy, the bio-organic movement included the Christian faith as an important aspect. The conservation of farming tradition and farming life style is an important aim of the movement. This traditional background might have its origin in the political history as a farmers' party. Further characteristics of the bio-organic thought style are the production of high quality food and to achieve better attributes regarding storage. Life in soils, i.e. animals, fungi, bacteria, etc. is thought to provide all nutrients in the most suitable form for assimilation by crops. The bio-organic movement exclusively involves organic fertilizers and aerobic manure preparation.

The *ecological* thought style is rather pragmatic and product oriented. It is strongly influenced by the increasing demand for high quality or natural products. Ecological cultivation helps to attain higher prices and is supported by governmental incentives. In contrast to the bio-organic and bio-dynamic thought style ecological farming is not based on a specific world view or specific farming concepts, but focuses on a natural production process without use of artificial and chemical additives. Scientific results or methods are used to combat pests or to avoid their occurrence in an ecological way. While the agricultural methods of the bio-organic and the bio-dynamic thought style have to adhere to the corresponding worldview, the methods of the ecological thought style only have to comply with the ecological principles of organic products. The health of the soil and the organisms are regarded as a basic condition for the production of organic food and the prevention of pests, rather than as a part of a holistic organism like in the bio-dynamic view.

But also scientists (e.g. researchers at the anthroposophical institute Goetheanum) or extension agents can belong to one of the thought styles of Table 1.

4.2. Thought style of scientists

Scientists supporting organic agriculture mainly act as researchers working at specific research institutes, as for example the

Research Institute of Organic Agriculture (FiBL), or in the organic sections of the national research institution Agroscope. They predominantly address issues based on natural sciences and economics. In addition, there are some minor academic or rather independent research groups within diverse institutions, like the Goetheanum or the Institute for anthroposophical veterinary medicine (IAVET). Scientists try to find new methods which allow to enhance physical or economic results. Furthermore, techniques to replace or reduce manual work are important. Scientists strive for the understanding of biological processes, referring to the current materialist epistemological bases of natural sciences. However, when developing new farming methods, research in organic farming has to take into account the specific organic guidelines and philosophies, since for instance synthetical substances or genetically modified organisms (GMO) are excluded. Thereby, the organic philosophies are in some cases in conflict with the conventional scientists' understanding of nature and its processes. Often scientists hardly understand the nature of experiential knowledge and therefore do not consider it (Röling and Pretty 1996). On the other hand, it is often difficult for farmers to understand the reasoning of scientists. A farmer illustrates this conflict and describes in which way he perceives the limits of scientific knowledge: "It is difficult to explain scientific knowledge in a generally understandable way. Chemistry divides everything into single components. But to bring all these parts together again is simply impossible, I suppose. But scientists are not interested in doing that at all. (...) And the way homeopathy works, is a mystery. These are powers, which we cannot see. We cannot see electricity either. But we can see the results or the effect which can be positive or negative" (interview with a farmer, 2007, translated from Swiss German).

4.3. Thought style of extension agents

In Switzerland extension in organic agriculture is based on public service offered by national and cantonal extension offices, the national organisation for the development of agriculture and rural areas (AGRIDEA) and private organizations related to the different movements of organic farming. The thought style of extension agents can be characterised by their role as moderators between the communities of scientists and farmers. Therefore, in organic farming, extension agents have to deal with a variety of worldviews and practices. The implementation of new methods means complying with different requirements depending on the farmer's philosophy.

Before being able to give advice, extension agents first have to gain sufficient knowledge about the peculiarities of an individual farm, the corresponding agricultural methods, and its underlying philosophy. This process provides a good insight into the experience and knowledge of farmers. An interviewee of the present study describes this situation precisely: "It is a basic idea of extension service to consider the knowledge of the farmers. During annual excursions [of AGRIDEA] for extension agents we have the opportunity to discuss these issues. I have the impression that the extension agents work along these principles. It is our task to gather different forms of knowledge and to link them to create a new horizon for new questions. Extension agents have insight into many different situations and thus can crosslink practical knowledge and integrate it into their services" (interview with

a representative of public extension service, 2007, translated from Swiss German).

5. Transdisciplinary co-production of knowledge in the development of organic agriculture

The assessment of the development of organic farming combined with the characterisation and analysis of the thought styles has shown that for a thorough investigation of the transdisciplinary co-production of knowledge one has to distinguish between three sequential, partly overlapping phases.

Phase 1 lasts from approximately the 1920s (first concepts of organic farming) to the mid-1970s (formation of the FiBL in 1974). Often pioneer farmers and researchers cooperatively were developing theories and methods based on practical and scientific knowledge, and tested them on-farm. This strong cooperation between the thought collectives allowed a successful knowledge co-production between actors. Research was never detached from practice. Experience and local knowledge were the basis of agricultural cultivation. Below, an interviewee describes the importance of local knowledge: “There is some form of knowledge that is essential for society. Important is not only the knowledge that it is spring when the cherry tree is in flower, but also the experiential knowledge and the confidence that the potato, that I set in spring, will grow. ... This is a form of knowledge which is sort of unconscious” (interview with a farmer woman, 2007, translated from Swiss German).

Research and application or implementation happened in parallel and were in constant interaction. One of the most prominent platforms to gain new knowledge was the Möschi-berg, a seminar centre offering courses and meetings to stimulate intensive knowledge exchange between organic farmers, researchers and extension agents.

The bio-dynamic and the bio-organic movement were developing themselves in a quite independent way. Although the bio-organic movement took across many elements from the bio-dynamic concept, it could not accept some aspects of the corresponding philosophical background (e.g. the inclusion of the movement patterns of the moon and planets; the mystic dimension). For this reason, bio-organic farmers adopted an alternative theory developed by Rusch (1952).

In this initial phase, the processes of knowledge production fully correspond to the four core characteristics of transdisciplinarity as defined by Hirsch Hadorn et al. (2007): Organic agriculture relates to a life-world problem, since it represents a form of sustainable agriculture and thus supports local and global sustainable food supply. The interconnection between farming and research involves transcending and integrating disciplinary paradigms. Moreover, on-farm research, which is commonly performed by (groups of) pioneers and shared with others, is an excellent example of participatory research. Always looking for integrated paradigms and seeing a farm as an all-embracing system independent from disciplinary boundaries, organic farming is an adequate example of the unity of knowledge beyond disciplines. In organic farming a successful cooperation between the actors involves the acceptance of different interpretations and implies that researchers and practitioners integrate their competencies into the research process.

Phase 1 is also a good example of strong transdisciplinarity (Max-Neef, 2005) by showing that there is not only a single reality but there exist different levels of reality (see Section 2, paragraph on transdisciplinarity) that involve diverse concepts, for example farming-related versus research-related concepts. The concept of different levels of reality shows that there can be a level of reality, which unifies two elements which cannot be compared or combined on another level of reality. A specific example is the anthroposophical philosophy, which includes the consideration of the position of moon and stars for sowing or harvesting on the one hand, and findings of microbiology on the other, which are both integrated in bio-dynamic farming. Moreover, the effect of the moon phases on plant growth and food quality, which exists in the bio-dynamic worldview but not in the scientific world, corresponds to the logic of the included middle which deals with phenomena that are simultaneously A and non-A (see Section 2 of this paper).

Phase 2 represents a first shift towards a disintegration process concerning the knowledge co-production between scientists and practitioners. The foundation of the FiBL in the year 1974 introduces a new stage which involves that research is done independently in a research institution. In the same line, extension services are introduced (e.g. on cantonal level) which offer exclusively extension service for farmers. However, the exchange and cooperation between farmers, extension agents and researchers remained good since they still had a strong common basis. Research projects were planned and implemented together with farmers, and many studies were performed on-farm.

Beginning in the 1990s, phase 3 introduces an increasing separation between science, extension and farmers. Responsible for this shift are mainly two developments:

- the introduction of further independent research institutions in the field of organic farming (e.g. established by the state and cantons) and
- the rapidly increasing market with regard to organic products.

Research projects have increasingly been planned without contact to farmers. Courses and platforms for knowledge exchange such as the Möschi-berg meetings became infrequent. Moreover, a new economical interest group was gradually emerging. This new economical movement entails that many farmers change to organic farming not only driven by philosophical but also by economical reasons. This led to the emergence of the ecological thought style (see description above). After the establishment of the NATURAplan programme of Coop in 1993, Migros implemented a store brand for organic products in 1995. With these programmes the two biggest retail trade companies in Switzerland promoted the selling of organic products. In the same period the State and the Cantons introduced incentives for the support of environmentally friendly forms of production and products from humane animal husbandry. These economic incentives have induced a rapid increase of organic farmers in the 1990s, i.e. a quadrupling of organic farms from 1160 farms in 1992 to 4710 farms in 1998 (Bio Suisse, 2003), which cannot be explained solely by philosophically motivated changes.

Looking at the development of phase 1 to phase 3 (see Fig. 1) we observe a shift towards a segregation of the thought

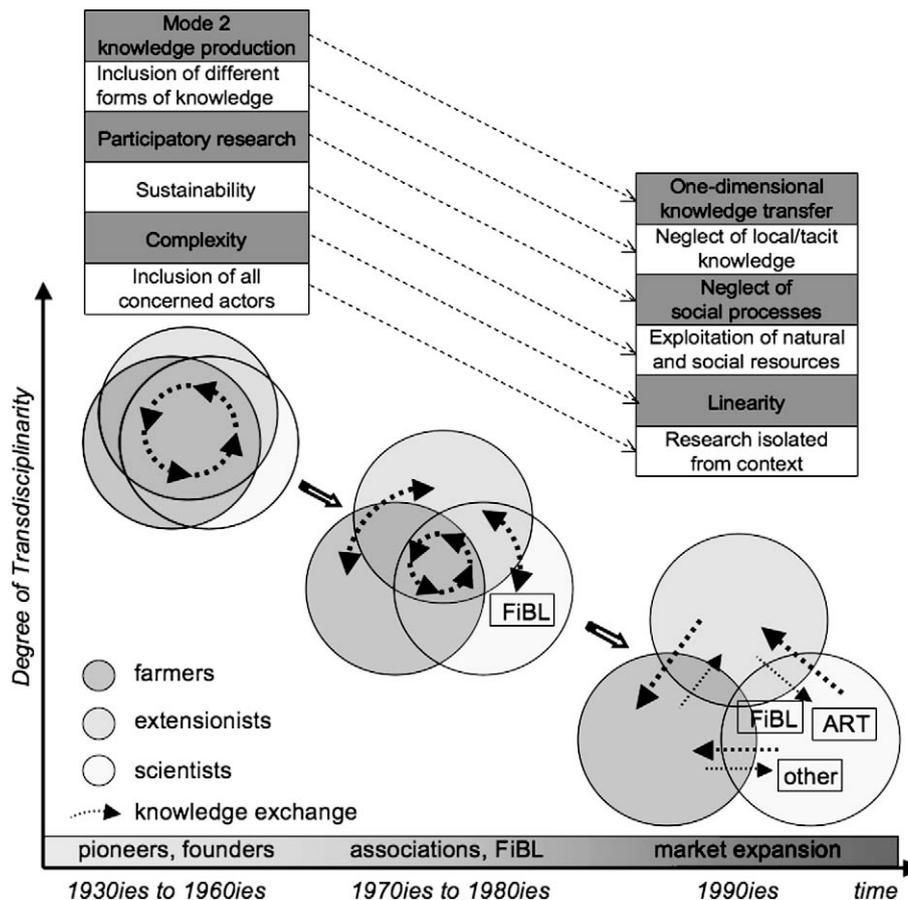


Fig. 1 – Development of the transdisciplinary co-production of knowledge in organic farming in Switzerland. The overlay of the circles illustrates the concordance of the thought collectives and thought styles of farmers, extension agents, and scientists, and the arrows represent the information flow between these thought collectives for three different phases in the development of organic farming in Switzerland. The position of the knowledge production system on the y-axis represents the degree of transdisciplinarity, the position on the x-axis the time period. The boxes above list characteristic aspects of transdisciplinarity for the initial phase in contrast to the current characteristics of knowledge transfer. “FiBL” is the Research Institute of Organic Agriculture, “ART” means Agroscope Reckenholz-Tänikon Research Station.

collectives: the initially strongly cooperating thought collectives involving the practical and scientific way of thinking, divide themselves into three rather separated thought collectives of farmers, researchers and extension agents. This development implies that the transdisciplinary co-production of knowledge, which at first involved multidisciplinary cooperation and happened in a context of application and thus strongly represents mode 2 knowledge production (Gibbons et al., 2005; Limoges, 1996), gradually moved towards a unidirectional way of knowledge production, rather representing a linear knowledge transfer from science to extension agents and from those to farmers. The role of farmers and their local knowledge became more and more marginal. This separation into the thought collectives of scientific and practical thought style implies that research is increasingly isolated from the context, because local knowledge and experience of farmers is hardly ever integrated in research projects since they do not correspond to scientific criteria. An interviewee of the present study puts it in the following words: “In former times the direct exchange between researchers, practitioners and extensionists was better. Today there is much less exchange. In former

times, there were events where researchers and practitioners met and commonly determined and discussed research topics. Today this does not exist anymore in the same way. Researchers define research projects themselves and do not discuss it with extension agents or farmers. This is a pity. Dynamics and debate, which are from my perspective two peculiarities of organic agriculture, are neglected” (interview with a representative of public extension service, 2007, translated from Swiss German). With the exception of some on-farm projects, today there is a substantial lack of direct contact between science and practice. Extension agents are the linking element between science or research and farmers. It is their task to comprehend the different views or thought styles and to connect them.

Pulling the strings together, Fleck’s theory of thought styles and thought collectives offers a good explanation for the changes concerning the co-production of knowledge during the three mentioned phases. This development is a good example for the dynamics of thought styles and thought collectives. Considering the reasons for the segregation of the thought collectives, the influence of the social and historical factors, which

are the two most important aspects of Fleck's theory, becomes apparent:

1. *Motivation for changing to organic farming*: In contrast to former times, today the motivation for a change to organic farming is not due to philosophical or ideological reasons anymore. Economic advantages of an organic quality product promising higher profit play an increasingly important role. Farmers do not consider and examine the principles of organic farming as intensively as they used to. Thus, the organic society constitutes a new social context. This phenomenon is linked to the changing political conditions in the field of agriculture. At the beginning of the organic movement, organic farming was rather counteracted by the policy system and governmental authorities. Currently, organic farming is supported through ecological incentives by the State.
2. *Acceptance of organic farming in society*: In phase 1 the organic movement was stimulated by pioneers who developed new ideas and concepts and did not necessarily follow the common way of life. Therefore, the pioneers were seen in the role of outsiders or newcomers and constantly had to defend their views and ideas. This created a strong social cohesion among the pioneers and promoted an intellectual and spiritual relatedness. Today, organic farming is regulated by laws, well positioned in the market, widely accepted in society, and organic farmers have laid down their role as outsiders. They are supplied by various means (specialised literature, extension services etc.) to find their way into the market.
3. *Economical conditions*: In former times, the only possibility to sale organic products was direct marketing or sale through small scale business. This often allowed for direct contact to the consumers. Today, the sale is mainly proceeded by big retail institutions. Direct marketing and sale on the public market are rather exceptional.

The capture of actors in their own thought styles as mentioned by Fleck (2002, p. 185/186) may inhibit cooperation between farmers and researchers and thus enhances the segregation of the thought collectives. To avoid a further segregation and to reinforce the cooperation, the different actor groups have to overcome the possible barriers between the thought collectives. One barrier might be the fact that the scientific thought collective seems to speak another language and has different ways of approaching actions than practitioners. Fry (2001, p. 112) has shown that farmers and scientists in their field of work have different aims and apply different methods in different contexts. These different aims, methods and contexts have an influence on the actors' perception, and involve different views about certain aspects as soil fertility, soil preparation methods, etc. To sum up, we see that conditions for transdisciplinary co-production of knowledge in organic agriculture have become increasingly more challenging.

6. Conclusion

The identification and analysis of the different thought styles and thought collectives of the actors in organic agriculture

forms a solid basis for the examination of co-production of knowledge observed in the past and present development of organic farming in Switzerland. This basis allows the identification and comparison of different forms of knowledge of farmers, scientists and extension agents including the consideration of their specific social, historical, philosophical and epistemological background. The study shows that there is a distinct evolution in the history of organic farming, which can be divided in three phases:

In the first phase (approx. 1920s to the early 1970s) scientists, farmers and extension agents were a strongly collaborating thought collective with a rather common philosophically motivated basis. Knowledge was generated by pioneers, who considered scientific knowledge as a useful input, but went beyond the philosophical and epistemological basis of natural sciences.

The second phase is characterised by the formation of the Research Institute of Organic Agriculture (FiBL) in 1974 and of independent extension institutions. This increasing institutionalisation of knowledge production involved a gradual segregation of the thought collectives of farmers, scientists and extension agents. However, the cooperation among them still remained rather strong.

The third phase (1990s) shows an ambivalent development. The wide acceptance of organic farming on the institutional (regulations, laws) and societal levels, the rapid growth of the organic market, and the growing influence of ecology on agricultural politics marked a very positive development of organic farming. However, these trends at the same time intensified the segregation of the thought collectives of practice, extension and research. Moreover, a new thought collective of rather economically motivated farmers emerged which stood rather in contrast to philosophically oriented thought collectives. This gradual disintegration of the diverse thought collectives provoked a decrease of the exchange between science and farmers and a loss of the corresponding innovation potential. Research has increasingly been based on natural science and economics, and the philosophical visions present in the former phases of the organic movement were marginalised.

The first phase of the development of organic farming represents a successful example of a transdisciplinary co-production of knowledge and contains numerous characteristics of diverse well-established definitions and concepts of current scientific notions of transdisciplinarity. Its origins are particular circumstances, namely the lack of existing research, common ideological motivation irrespective of the specific features of the thought collectives involved, and the obligation to rapidly find solutions for problems which were non-existent until that time. This situation formed a strong collective of similarly thinking people with common interests.

The specific circumstances of organic agriculture do not allow a simple transfer to other areas. Most often transdisciplinary research is initiated externally and driven by the insight, that this kind of research leads to improved applicability, acceptance concerning implementation, and to more sustainable ways to problem solving (Rist and Wiesmann, 2003; Hirsch Hadorn et al., 2006). Normally, the evolution leads from unidirectional knowledge transfer towards knowledge interfacing (Roux et al., 2006), and thus moves the opposite

way than observed in organic farming. However, many of the forms of knowledge exchange in organic farming can give important advice and stimulus for other areas and for the development of basic concepts.

For the future of organic farming an inversion of the observed development process is desirable. Due to the lacking contact of scientists and practitioners it became increasingly difficult to develop methods which are suitable for implementation of new findings into practice. In organic agriculture science possibly has to develop different solutions for diverse target audience or thought collectives respectively, like for bio-dynamic and bio-organic farmers for whom there often have to be found individual or specific solutions (often on-farm in cooperation with extension agents) in contrast to economically oriented farmers who rather act upon the guidelines of the market.

An important finding of this study concerns the linking between the institutionalization of knowledge that has been developed outside of mainstream science and the observed forms of transdisciplinary processes. The institutionalization of knowledge produced under conditions which inherently demand transdisciplinary work, namely uncertainty, controversy and complexity, can lead to a dilemma that the price of significant societal recognition seems to be the loss of the philosophy and pathway through which the solution has been elaborated. Such a dilemma can be observed in organic agriculture during its present phase in Switzerland. However, the analysis also shows that this situation is not only caused by external influences to the movement of organic agriculture: If the organic movement had not only promoted the results of the transdisciplinary co-production of knowledge, but also had attempted to institutionalize the forms of knowledge production through which organic agriculture has been developed, the dilemma perhaps could have been overcome to a certain extent. Thus, initiatives that aim at the promotion of transdisciplinary co-production of knowledge should at the same time ensure the institutionalization of its results as well as its forms of transdisciplinary knowledge production. In this sense, a thorough reflection and analysis of the process of transdisciplinary co-production of knowledge in the history of organic farming is crucial in order to find new forms of cooperation, experience exchange and knowledge transfer between the scientific and the practical (and possibly the political) world.

Strategies and methods to reverse the observed trend, i.e. a decrease of transdisciplinary cooperation, are major subjects of our subsequent research work. However, based on the findings above, first ideas towards such strategies involve joint reflection of farmers, scientists and extension agents on knowledge production processes. Also, bringing together these actor groups with researchers who deal with the theoretical perspectives of transdisciplinary knowledge co-production may be another important strategy to reverse the observed situation. Moreover, it would be interesting and illuminating to extend the analysis to other European countries with similar tendencies and developments.

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Article II

**Power and Knowledge Co-Production – A Case Study of the
Development of Organic Agriculture in Switzerland**

Power and knowledge co-production – A case study of the development of organic agriculture in Switzerland

Andrea Aeberhard¹, Stephan Rist²

ABSTRACT. The development of co-production of knowledge in organic agriculture shows three different phases. While the societal, economic, and governmental recognition of organic farming has strongly increased from the first to the third phase, the intensity of knowledge co-production has gradually declined. The present study investigates if and in what way power relations play a role in this ambiguous development, and analyses the three phases of knowledge co-production in organic farming. The findings of the study reveal that there has been a significant shift from power relations within the organic movement towards asymmetries of power between the organic community on the one hand, and related external actors such as retailers, policy makers, and scientists on the other. Furthermore, in the course of time various identified power relations have increasingly become asymmetric, and thus have significantly influenced the decrease of the intensity of knowledge co-production.

Keywords: knowledge co-production; organic agriculture; power; transdisciplinarity; sustainability science

INTRODUCTION

Within the field of sustainability science, which seeks to understand the basic characteristics of interactions between nature and society (Kates et al. 2001), there is a growing consensus that knowledge generated in science and society has become increasingly interdependent (Elzinga 1997, Grunwald 2004) and that knowledge production cannot be perceived as a result of a linear process in which solutions proposed by science determine actions taken outside of the scientific community (Roux et al. 2006). Transdisciplinary approaches to knowledge co-production involving members of multiple levels, i.e. scientific and non-scientific communities, are therefore a basic aspect of sustainability science (Cash et al. 2006). Consequently, relationships between the societal, scientific and political world can be understood as products of a process of co-production of knowledge through which actors affirm their identities and the legitimacy of their claims and practices (Luks and Siebenhüner 2007).

Especially at the beginning of its movement, organic farming in Switzerland represented a very successful case of transdisciplinary co-production of knowledge between farmers, scientists and extension agents, which has not been perceived as such in the past and present scientific discussion (Aeberhard and Rist 2008). Knowledge was not predominantly generated by scientists and disseminated through extension agents, which would represent the traditional linear way of knowledge diffusion, on the contrary, knowledge was mainly developed by ecologically committed practitioners or pioneers, so that conventional scientific knowledge systems played a minor role compared to organic farming practices (Gerber et al. 1996, Lehmann 2005). The present study emphasises that transdisciplinary knowledge production involves different academic disciplines working jointly with practitioners to solve a real-world problem

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(Klein et al. 2001), includes transcending and integrating disciplinary paradigms, relies on participatory research, implies the search for unity of knowledge beyond disciplines (Hirsch Hadorn et al. 2007), and breaks with the assumption of a single reality (Max-Neef 2005). These aspects of transdisciplinarity are crucial for assessing the different and sometimes contrasting phenomena within the organic movement, as for example philosophical beliefs vs. economic needs. Although there is a growing body of literature about the societal implications of transdisciplinarity (e.g. Klein et al. 2001, Hirsch Hadorn et al. 2007, Wiesmann et al. 2008), little work has been done on how power relations influence the process of knowledge co-production and how they enable and inhibit the intensity of knowledge exchange.

Transdisciplinary co-production of knowledge in the development of organic farming in Switzerland shows three different phases. In the course of these three phases an ambiguous trend can be observed: on the one hand, organic farming, which initially was a rather little accepted newcomer movement, has enjoyed a continuously growing societal, political and economical recognition; on the other hand this development is associated by a gradual loss of very valuable forms of transdisciplinary knowledge production (Aeberhard and Rist 2008).

The present study aims at identifying reasons for this ambiguous development, by putting a special focus on power relations. Concepts of power are of interest to numerous fields of social science and represent a very useful theoretical framework for the analysis of transdisciplinary knowledge production. The importance of power relations has already been demonstrated by pointing out unequal participation in knowledge production processes in agriculture (Morgan and Murdoch 2000, Derkzen and Bock 2007). This study hypothesizes that power imbalances play an inherent role in knowledge co-production processes, and, in particular, that asymmetric power relations may be possible reasons for the observed decrease of the intensity of co-production of knowledge in the development of organic agriculture. The findings of the present study will help to support the high innovation potential of the organic movement, and to find strategies for ameliorating knowledge co-production, to which organic agriculture and other fields of sustainability science could relate more systematically in future.

METHODOLOGICAL FRAMEWORK

The present study is based on qualitative research methods, including document analysis, semi-structured interviews (data collection), critical case sampling (actor selection), transcription and thematic coding. For a detailed description see appendix.

Concepts of power

Power aspects related to transdisciplinary knowledge production in the development of organic agriculture are the major focus of the present study. There exists a variety of theoretical frameworks of power (e.g. Flyvbjerg 1998, Dowding 2003, Lukes 2005). We use concepts of power which are suitable for supporting the examination of co-production of knowledge in organic agriculture. Generally, power can be described as the opportunity of a person or institution (organisation, group etc.) to control or influence the choices or actions of other persons or institutions. The influence of power can have both negative and positive effects. The classical approach by French and Raven (1959), which has been further developed by Raven (1993), forms the basis of

numerous additional theoretical power concepts, and distinguishes between five different types of power:

Legitimate (also known as normative) power: Power of persons who are elected (e.g. governmental position) or appointed to a superior position (e.g. the leading person of a firm), which gives them the formal authority to prescribe and regulate the behaviour of (groups of) people.

Reward power: Power or ability to confer rewards in different forms like material value (gifts, promotions), social value (appreciation, recognition), or other benefits.

Coercive power: Power based on being in the position to exert negative influence (degradation, dismissal) or to sanction or punish people who do not comply with one's ideas or demands.

Referent power: Power to attract and gain the loyalty of persons, who feel honoured to follow and support the leading person. It is based on the charisma of persons in power, and on the desire of their followers to identify with their attributes and qualities.

Expert power: Power based on possessing distinctive knowledge, expertise and skills, controlling the information that other people need to achieve their goals. This form of power is restricted to specific areas of knowledge in which persons are experienced and qualified.

These types of power can be considered in various ways in connection with transdisciplinary knowledge co-production in organic farming. At first place, *legitimate power* plays a role, for instance, in relation to the recognition of organic products by governmental authorities. The introduction of incentives by the state, or public relations campaigns on organic products of retailers are forms of *reward power*. Moreover, the dependence of the recognition of products as 'organic' (certification) on the compliance with rather rigid guidelines, which includes social and economic sanctions, implies *coercive power*. Furthermore, the fact that organic farming, especially in its first phase, was strongly influenced by its two founding fathers, Rudolf Steiner and Hans Müller, shows the significance of *referent power* in the development of organic agriculture. *Expert power* is attributed to scientists or extension agents who are involved in knowledge production processes in the organic movement. These five types of power are used to analyse on the one hand the relationships of power between actors within the community of organic farming, and on the other, between actors of organic agriculture and external actors (retailers, policy makers, scientists), and their influence on knowledge co-production.

Experiential vs. scientific knowledge

The added value of the inclusion of experiential knowledge in collaborative research or co-management processes has been widely discussed in the recent scientific literature (e.g. Cundill et al. 2005, Chalmers and Fabricius 2007, O'Flaherty et al. 2008). Thus, for the investigation of transdisciplinary co-production of knowledge in organic farming involving practitioners and scientists, it is important to distinguish between farmers' (experiential) and scientists' (scientific) knowledge. By experiential knowledge we mean rather pragmatic, intuitive and holistic knowledge; it can be a combination of selected aspects of scientific knowledge and knowledge based on an individual's own

experiences and observations, often also including philosophical belief components (Ingram et al. 2008). In contrast, by scientific knowledge we refer to rather theoretical, reasoned and highly specialized knowledge produced on the basis of formalised and standardised research methods.

POWER AND KNOWLEDGE CO-PRODUCTION IN THE DEVELOPMENT OF ORGANIC AGRICULTURE

As follows we examine the three different phases of transdisciplinary knowledge co-production in the development of organic agriculture in Switzerland as described by Aeberhard and Rist (2008) with a special focus on the role of power relations between actors or institutions. The examination of each phase involves three steps. First we shortly characterise the phase, then we address forms of power which occur within the organic community, and thirdly we investigate power relations between the actors of organic agriculture and external actors. To support our analysis we relate to the concepts of *legitimate*, *reward*, *coercive*, *referent*, and *expert power* (French and Raven 1959; Raven 1993) which are described above.

Phase 1: 1920s to mid-1970s

The first phase encompasses the beginning of the organic movement of the 1920s to the mid-1970s. Organic farming has emerged as a counter movement of philosophically motivated pioneers to the industrialization of agriculture. In its initial phase the organic movement was mainly driven by an alliance between philosophically motivated leaders and practitioners who were fighting the growing industrialization of agriculture and food production. These pioneers were largely considered as an outsider group, as shown in the following quotation:

In former times organic farming was seen as somehow dirty. People thought that organic farmers would have long hair, and that their farms would be a mess... After having changed to organic farming my relatives said: you used to be a straight fellow, but now you are foolish (organic pioneer farmer 2008).

Thus, initially organic concepts and ideas were denied by society, governmental institutions, and mainstream science. Due to this societal and political marginalisation the organic community acted as a rather closed and self-contained network with more or less common worldviews and ideas, which produced a strong internal cohesion and mutual intellectual integrity. Thus, power relations predominantly existed among the internal actors of the organic network. The members of the organic movement set the norms themselves – mainly on a philosophical level. Moreover, the leaders of the organic movement provided rather symbolic rewards and guidelines. Hence, *legitimate* and *reward power* were widely assigned to the members of organic farming. As certification of organic agriculture was rather unimportant in the initial phase, there was no need for the establishment of a sanction system. Consequently, *coercive power* relations were not prominent in this phase.

Since knowledge about organic farming was mainly owned by organic farmers, who implicitly held a broad experiential knowledge background, also *expert power* was attributed to the internal actors of the movement. In the first phase, research mainly involved the development and improvement of organic cultivation methods and was predominantly performed collaboratively by farmers and scientists of the organic

movement, who shared their problems and tried to find common solutions. The newly developed philosophical concepts were mainly applied by pioneer farmers, who had to find corresponding implementation methods. Due to common interests communication and cooperation among the organic pioneers was relatively easy. The Goetheanum, an anthroposophical School of Spiritual Science (Dornach, Switzerland), holds a research section which has developed the basics of bio-dynamic farming. However, knowledge has mainly been generated by on-farm experiments performed by farmers.

Moreover, the initial phase was strongly influenced by the *referent power* of the two intellectual leaders of the main organic movements, Rudolf Steiner in the first years before his death 1925, and Hans Mueller, and their philosophical background and theoretical ideas. They both strongly supported the cooperation and discussion among farmers, pioneers and developers of ideas and principles. In the case of bio-dynamic farming Steiner's *referent power* played an essential role by initiating the anthroposophical movement. Later this movement was growing, and was also stimulated by the Goetheanum. In organic farming Mueller enhanced mutual knowledge production by supporting farmers' and researchers' cooperative implementation of Rusch's theoretical concept named cycle of living substance (Rusch 1952), which was based on the scientific knowledge of microbiology of that time. The resulting farming methods were tested on-farm. Moreover, the Farmer Homeland School 'Moeschberg' supported the exchange of ideas between farmers, scientists and extension agents in the field of organic agriculture. Thus, the *referent power* of these leading persons had an enhancing influence on knowledge exchange and co-production in the initial phase of organic farming.

External power influences as for example by policy makers or large retailers were hardly present. Farmers mainly sold their products by direct marketing. Their target customers were philosophically motivated consumers who appreciated the opportunity to buy products that corresponded to their philosophical beliefs. The wide political and societal denial impeded the extension of the ideas of organic agriculture beyond its network, and thus external power influences were marginal. Neither economical or political rewards nor formal norms or guidelines came from outside of the organic movement. Thus, *reward*, *legitimate* and *coercive* and power relations between external actors and actors of organic farming did not play an important role in the first phase. Moreover, since conventional agronomy or ecology sciences did not address organic farming methods at that time, also external *expert power* influences on the knowledge co-production processes were not significant in this phase.

To sum up, the strong internal collaboration in the initial phase of organic agriculture facilitated intensive and well coordinated knowledge co-production processes within the organic movement, and power was attributed almost exclusively to the internal actors of organic agriculture. External power relations did not play a significant role in processes of knowledge co-production in the first phase of organic farming.

Phase 2: mid-1970s to 1990s

The foundation of the first research institution of organic farming, the Research Institute of Organic Agriculture (FiBL), in 1974, which aimed at supporting organic farming pioneers with scientific research, represents a first step towards the formalization of knowledge production within a specialized science based institution, and thus introduces the second phase. Although on-farm projects and experiments were still

carried out, research increasingly was organized by scientists, who gradually have become more independent. In the early stages of FiBL, beside few experienced people also young rather inexperienced but philosophically motivated scientists joined the institution and appreciated farmers' practical experience, which they were dependent on: "In these times there was only little material. At the beginning, we got the knowledge from the farmers" (pioneer researcher at FiBL 2008). The dependence of scientists on farmers' experiential knowledge stimulated exchange and co-production of knowledge.

However, the growing orientation of the newly emerging organic research to conventional agronomic research implied that research questions increasingly focussed on issues which were relevant for mainstream research and tended to neglect the need for finding solutions for farmers' practical problems. As a consequence, research started to give more importance to consolidating a science based understanding of organic agriculture, which did not so much relate to farmers' practical needs. Moreover, because some basic principles of organic farming, as for example animal healing with medicinal plants and homeopathic preparations, or the influence of astronomic constellations on plant growth, are difficult to support by scientific analysis, they have gradually lost importance. In this sense, *expert power* more and more shifted from farmers to scientists who increasingly neglected the inclusion of practical knowledge into their research and rather emphasised principles of conventional science.

Moreover, phase 2 was characterised by the struggle of the members of organic farming for political recognition. Because all corresponding attempts in the 1970s had failed, in 1981 five Swiss organic agriculture organizations jointly founded an umbrella association, Bio Suisse, and mutually defined common norms and certification systems for organic farming under a common label, the so-called Bud label. Since norms and guidelines of Bio Suisse were defined by the members of the organic movement, *legitimate power* was still attributed to the internal actors of the organic movement. The development of norms and standards for organic farming involved intensive knowledge production between different organic associations of farmers, consumers and traders of organic products (Bio Suisse 2008).

Along with these processes, the formerly very positive effects of Mueller's *referent power* on knowledge production has also changed in the course of time: Mueller more and more rejected newly generated knowledge and points of view which were different from his own ones. In particular, the denial of the nomination of a potential successor, which would have allowed the continuation and further establishment of the movement and the Moeschberg centre, has led to a gradual decrease of knowledge exchange and dissemination:

He [Mueller] acted in a very authoritarian way. He was not able to come to consensus or agreement. (...) Some people say that in those days it needed a person like him to achieve something. You can see it this way, but you can see it also the other way around. His behaviour made any kind of cooperation or collaboration among people impossible, who had more or less the same opinion or disagreed only slightly (pioneer farmer 2008).

Hence, by Mueller's rather dogmatic way of acting his *referent power* increasingly had a hindering effect on co-production of knowledge. The changing role of this leading

person and the emergence of broad networks of different farming organisations, the introduction of an independent research institute and new certification systems entailed that *referent power* was increasingly assigned to organisations and not to single persons anymore. However, the attribution of *referent power* to organisations does not fully comply with Raven's notion of *referent power* (Raven 1993), which is attributed to single charismatic individuals.

Furthermore, the growing economic success included a first decrease of interest in knowledge exchange:

It is like always, if something is new: at the beginning one is committed and active and wants to exchange knowledge. But once it runs well, you tend to rest on your laurels and are less interested in participating in meetings with others (organic farmer 2008).

The organic community, which initially mainly encompassed the core group, has increasingly been enhanced by new rather economically inspired farmers. Thus, the principles of and reasons for organic farmers were not as uniform as they used to be, which caused a first decline of intensity of internal knowledge exchange.

We will now analyse relationships of power between external actors and actors of the organic community in phase 2. Society's awareness of increasing environmental damages, like for example forest dieback, loss of biodiversity and pollution of water, soil and food was growing. The related environmental activism and academic critique has aroused societal interest in ecological ways of food production and farming. Due to this development, in the second phase, the rejection of organic farming by the wider society, policy makers and traditional science began to recede. Retailers reacted with the introduction of ecological labels and enforced advertisement for organic products, which helped to enhance the image of organic farming, and policy makers introduced incentives for more ecological farming, which both represent forms of external *reward power*. The guidelines which related to the new ecological labels and incentives also entailed the necessity of controlling procedures and farmers' compliance with specific regulations, which involved that retailers and public authorities obtained *legitimate* and *coercive power* over organic farmers. Along with this development, the acceptance of organic farmers by society, policy makers and economists has grown, and consequently the initial marginalisation of organic farming has decreased and involved that the previously self-contained organic movement has gradually opened up, which enabled the opportunity of external power influences. However, since mainstream science still largely ignored organic farming methods, external *expert power* has not yet played a significant role in phase 2.

To sum up, we state that the introduction of the first independent research institution and the growing opening of the organic market entailed a first shift of influence from internal to external power relations in organic farming and involved a first decline of intensity of transdisciplinary knowledge co-production.

Phase 3: 1990s to present

The third phase starts in the 1990s and lasts up to present. Nowadays organic farming is widely accepted in society and by consumers, and is supported by a variety of incentives. A farmer puts it in the following words:

In former times, if you mentioned organic farming in a meeting of conventional farmers, they said things like: ‘they only do it [fertilizing] at night’. And they wanted to prohibit the use of an official label of organic products. Today, nobody would say this anymore (organic pioneer farmer 2007).

This development and the increased promotion of organic products, as public relation campaigns of retailers and increased advertisement, have enhanced the visibility and image, and has virtually led to a boom of organic agriculture. The longer the more, many farmers have changed to organic farming mainly due to economical interests. In contrast to the bio-dynamic and bio-organic worldviews, which are based on specific philosophical ideas and consider the farm as a holistic organism, the motivation of these farmers relates to a new rather pragmatic and product oriented mentality, which focuses on the production of organic products, because these are supported by governmental incentives and represent high quality products with correspondingly higher prices (Aeberhard and Rist 2008).

In the third phase internal norms, guidelines and rewards and corresponding *legitimate, coercive* and *reward power* did not play an important role anymore. However, internal *expert power* has increasingly shifted from farmers to scientists, on the one hand, because researchers at FiBL have gradually attained a larger knowledge background and were less interested in farmers’ knowledge, and on the other, because of an increasing lack of farmers’ pioneer attitude and interest in joint knowledge production. In former times, farmers managed the great diversity of their farms mostly based on reliable intuition, traditional knowledge and lifelong experience (Bartsch 1930). Today, “farmers forgot to ask ‘why’ again and again. Perhaps farmers still have the feeling and the understanding, but they don’t dare to live it” (pioneer researcher 2008).

The external influence of market and corresponding *reward power* has become very strong. The impact of consumers’ wants and governmental incentive systems are both related to *reward power* in the sense that they ensure the income of farmers and reward their efforts of producing healthy food: “If Coop [large retailer] quits selling organic products, I would have a big problem” (organic farmer 2008). However, the ephemeral trends of the market represent a problem to organic food production since a change of cultivation and production from one product to another requires time, in particular for acquiring new knowledge and methods. In this sense, the president of the Swiss umbrella organisation of organic farming (Bio Suisse) emphasises:

In agriculture one can change production, but one cannot change production overnight. The production rhythm of agriculture cannot keep up with industry, which can say: ‘Tomorrow we produce 1000 slippers and the day after 2000 sandals’. To me the biggest problem is that changes introduced by policy and market happen so quickly (interview 2007).

Moreover, the wants of consumers and the corresponding market power can be strong enough to put farmers’ philosophical ideas in the background:

A typical example is the market in Berne. You find farmers who go there as the third generation. They say, in former times we have grown products based on seasonality. Then the pressure came up, that if one did not offer peppers in March, one was not

competitive anymore, because consumers want peppers in March (organic farmer woman 2007).

Therefore, many farmers are forced to adapt their farming strategies to the political and economical trends:

At the beginning we had different kinds of cultivations. Now we reduced the diversity. We don't have mother cows anymore and we have reduced the diversity of cultures, simply that we can master the work (organic farmer 2008).

This shows, that nowadays the market has power and influence on organic farmers' way of food production. However, few innovative farmers could avoid the influences of the market by taking the opportunity to create an own market and growing and offering niche products. A farmer growing herbs for tea on a smallest size farm proudly states: "It is us who define the price of our products, not retail business" (Brotschi 2008). Nevertheless, both processes, the market requirements and the search for niche products entail that farmers' interests and efforts are more and more focussed on the market development, involving a consequent decrease of engagement for the advancement of organic ideas and corresponding knowledge production.

Along with the gradually increasing specification and sophistication of regulations and guidelines by the government and organic certification institutions, the influence of corresponding *legitimate* and *coercive power* rises. The power of regulations and producer guidelines can result in a possible deprivation of the organic label, if a farmer does not comply with a certain regulation. The influence of *coercive power* related to controlling mechanisms is increased by the fact, that guidelines are often changed or further specified. Farmers are generally annoyed by the complexity of regulations. They regret the loss of the focus on the basic principles of organic farming:

It [the controlling and certification process] is an enormous paperwork and sometimes the common sense simply gets lost. The controller should have a look at the farm as a whole and try to feel how the farmer works, and not only mark with a cross if it is good or bad. This year, the only thing they complained about was that we had not changed a single number on a price tag. This is really a minor point and very marginal (farmer woman 2008).

Verifying to comply with every detail of the guidelines absorbs much of farmers' precious working time. Thus, the *coercive power* of controlling mechanisms diminishes the available time for knowledge production and exchange. Moreover nowadays, the growing specialisation and standardization of production processes increase the dependence of farmers on external knowledge, marginalise the importance of experiential knowledge, and thus assign *expert power* to the external scientific world:

In former times there were events and activities where practitioners and researcher exchanged their ideas and where they discussed and defined common research topics. Today, researchers define their research topics themselves and do not discuss with extension agents or farmers anymore, this is a pity. Dynamics and debate, which are in my opinion most important peculiarities of organic farming get lost (extension agent 2008).

The developments described above have led to a decreasing intensity of knowledge co-production in the third phase. We will now discuss the enabling and inhibiting effects of the power influences identified in phase 1 to 3 of the development of organic farming on knowledge co-production.

IMPACTS OF POWER ASYMMETRIES ON KNOWLEDGE CO-PRODUCTION

The analysis of the three phases of knowledge co-production in the development of organic agriculture supported by the theoretical framework of the five power types of Raven (1993) shows that a variety power phenomena occur in each of the three phases. We observe that power relations have enabling and inhibiting influences on knowledge co-production. The study reveals interesting patterns concerning the distinction between internal power relations within the community of organic agriculture and external power imbalances between the members of the organic community and external actors, as for example policy makers and retailers (cf. table 1, two bottom rows). While the initial phase of organic agriculture primarily involves internal power relations (mainly *referent* and *expert power*), the third phase predominantly shows a shift from internal power relations to an increasing external determination of organic community through power impacts by external actors. It is striking that external power influences have almost exclusively hindering effect on the intensity of co-production of knowledge. Therefore, the increasing external determination of organic agriculture was a major reason for the decreasing degree of transdisciplinary co-production of knowledge. Table 1 summarizes the influence of the five power types on co-production of knowledge in organic farming.

Table 1: Occurrence of different power types during phase 1, 2, and 3 of the development of organic agriculture (OA) in Switzerland (first six rows), and the influence of the power phenomena on co-production of knowledge (CPK) (last two rows).

	Phase 1: 1920s – 1974	Phase 2: 1974 - 1990	Phase 3: 1990 to present
Main actors	Philosophically motivated pioneer farmers and scientists	Philosophically motivated farmers and researchers at FiBL, organic association (Bio Suisse)	Economically motivated farmers, government, consumers, large retailers, policy makers, mainstream scientists
Who sets norms? (<i>legitimate power</i>)	Members of OA	Members of OA together with philosophically motivated scientists	Policy makers, retailers, mainstream scientists
Who provides rewards? (<i>reward power</i>)	Individual leaders of OA provide symbolic reward	Retailers and organic associations (introduction of organic labels)	Large retailers (marketing, promotion of organic products), policy makers (incentives)
Who defines and implements guidelines and sanctions? (<i>coercive power</i>)	Leaders of OA set philosophical background (no sanctions)	Bio Suisse introduces first guidelines and sanctions	Policy makers, Bio Suisse, large retailers
Who is in referent role? (<i>referent power</i>)	Leading persons (Rudolf Steiner, Hans Müller)	Hans Mueller governs bio-organic movement	Policy makers, retailers, no specific leader persons anymore
Who controls knowledge production and exchange? (<i>expert power</i>)	Pioneer farmers of OA; researchers at the Goetheanum in collaboration with farmers.	Farmers in collaboration with researchers	Scientists at FiBL and governmental research institutions
	↓	↓	↓
Power relation within OA affecting CPK	Members of OA set internal regulations themselves, as far as they are necessary (no relevant influence of <i>coercive</i> or <i>reward power</i> on CPK). Strong influence of the leading persons (Steiner and Mueller) supports knowledge exchange and CPK. <i>Expert power</i> is attributed to farmers who possess broad experiential knowledge (enables CPK).	Since scientists still depend on farmers' knowledge, the intensity of CPK is rather high. Foundation process of Bio Suisse stimulates CPK among the five organic associations. Introduction of first guidelines entails controlling procedures. Dealing with regulations absorbs farmers' precious time, negative effect on CPK. Mueller's authoritarian way of acting (<i>referent power</i>) had hindering effect on CPK.	Scientists possess <i>expert power</i> . Farmers are less interested in knowledge production, thus less CPK. <i>Coercive</i> (internal guidelines) and <i>reward power</i> are less important compared to external influences (guidelines, incentives).
Power relation between OA and societal, political, economical world affecting CPK	Strong internal coherence through marginalisation of OA of policy makers and society (enabling of CPK). No external <i>coercive</i> or <i>reward power</i> influence. OA was ignored by mainstream science, no <i>expert power</i> influence.	External influences are still small, but marketing by a large retailer starts to increase economic interests (lowered interest in CPK) Conventional scientists did not yet address OA: still little external <i>expert power</i> influences.	Broad recognition of OA enhances intrusion of external interests and influences. Increasing influence of external scientists of governmental research institutions, who do not include experiential knowledge (inhibits CPK). External power influences (<i>reward, coercive</i>) absorb much of farmers' time, thus weakens the advancement of knowledge and consequently inhibits CPK: <ul style="list-style-type: none"> • Constraint of compliance with more and changing guidelines • increasing economic interests (incentives) • consumers' wants

As follows we discuss enabling and inhibiting influences of the different power types on knowledge co-production.

Referent power, which occurred within the organic community, was the first of the five power types, which had an important influence on the development of co-production of knowledge in organic farming. The leading persons of the bio-dynamic and bio-organic movements, Rudolf Steiner and Hans Mueller respectively, have attracted the interest and loyalty of an increasing group of farmers, and thus were obvious carriers of *referent power* which had enabling as well as inhibiting effects on knowledge exchange and production. On the one hand, it helped to constitute a community and maintain a common understanding, which enhanced co-production of knowledge, and contributed to institutionalise knowledge exchange, for example by the establishment of regular Moeschberg meetings. This mainly happened in the first phase. On the other hand, if the referent gets dogmatic and represses new or diverging ideas, which was observed mainly in the second phase of the bio-organic movement, *referent power* hinders internal collaborative knowledge production.

With respect to *reward* and *coercive power* relations, those between the organic community and the wider society, which mainly occurred in the third phase, were most important. *Reward power*, i.e. market promotion and incentives, supported ecological food production due to the growth of the organic market in a positive way, but implied an increasing alienation from original ideas of organic farming, which had an inhibiting influence on co-production of knowledge:

The negative aspect is that the expansion of organic farming caused that the debate about the original principles of organic farming has somehow decreased. The idea of organic farming has been conventionalised (extension agent 2008).

Such an influence of *reward power* did not exist in the first phase of organic agriculture and has only emerged in the second (market) and third (market, and governmental incentives) phases through external actors. In the same sense, *coercive power* aspects such as guidelines had an inhibiting influence on knowledge co-production, because the dealing with controlling systems absorbs intellectual and temporal capacities of farmers and institutions.

A very important power aspect relating to knowledge co-production is the changing asymmetry of power between scientific and farmers' experiential knowledge. Asymmetries relating to *expert power* exist on the one hand within the organic community between farmers and researchers at FiBL, and on the other in relation between organic farmers and the external scientific community, which does not strongly relate to organic agriculture. The formation of independent research institutions dealing with organic farming has led to an increase of power asymmetries between professional scientists and farmers, and to a growing difference in the philosophical background between scientists and farmers, which also may reduce co-production of knowledge. In the first two phases, knowledge co-production depended largely on experiential knowledge. Knowledge was well distributed and asymmetries of *expert power* hardly existed. In the third phase, this situation has changed and shows a typical pattern: knowledge has increasingly been unevenly distributed among actors of organic agriculture, in particular, knowledge and thus *expert power* was strongly attributed to scientists. Most interestingly, this pattern has also been described by other studies

relating to networks or partnerships of farmers and scientists in agriculture: Farmers' knowledge has been displaced by standardised (scientific) knowledge (Morgan and Murdoch 2000), the specialised knowledge of scientists creates a clear power imbalance between scientists and practitioners (Derkzen and Bock 2007) and inhibits participation of practitioners in collective discussions, especially if scientific research on organic farming has been performed in a traditional linear way (Boshuizen et al. 2004). In this sense, the specialisation of research, the growing difference between the philosophies and aims of scientists and practitioners, and the farmers' decreasing interest in basic organic farming principles have led to increasing power asymmetries between scientists and practitioners, and was an important reason for the decline of co-production of knowledge in organic agriculture.

CONCLUSION

The present study has analysed the three phases of the development of organic agriculture in Switzerland with a special focus on the occurrence and role of five power types and their influence on transdisciplinary co-production of knowledge. The study corroborates the hypothesis that these power types play an inherent role within each of the different phases. Moreover, it reveals the importance of distinguishing between power relations among the members of organic agriculture and power relations between them and external actors as policy makers or retailers. It is shown that power influences of actors outside of organic agriculture predominantly have inhibiting influence on transdisciplinary knowledge co-production. The strong increase of external power influences in the third phase mostly in relation with a growing external determination is an important reason for the decreasing intensity of transdisciplinary knowledge co-production. Furthermore, the study shows that one type of power can have enabling as well as inhibiting impact on co-production of knowledge:

- Increasing *reward power* of retailers and government supported organic farming in general, but shifted the focus of the organic community from more philosophical and holistic thinking to rather economic interests.
- The increasing external *coercive power* in relation with the growing domination of certification and regulations absorb farmers' precious time to comply with standards, instead of being able to concentrate on the original philosophies and paradigms of organic farming involving corresponding knowledge production.
- The influence of internal *referent power* strongly depends on the attitude of the leading person: by keeping together the community and cultivating a common language and exchange of experience, *referent power* enables knowledge co-production. But it is hindering, if it becomes authoritarian and represses the consideration of new or different ideas.
- Asymmetries of *expert power* between scientific and experiential knowledge strongly determine knowledge exchange: *expert power* enables knowledge co-production, if it is equally assigned to farmers and scientists. However, it turns into an inhibiting factor, as soon as it is related to specialised, formalised, or abstract knowledge, which allocates power predominantly to science.

In general, we see that transdisciplinary co-production of knowledge in the organic agriculture movement is strongly depending on power balances between its core actors, i.e. farmers, committed scientists and extensionists, and external actors like policy makers, retailers or consumers. At the present time, the initially high degree of transdisciplinary knowledge co-production in the development of organic agriculture is

endangered because the organic movement has increasingly lost the internal control relating to all five power types. Organic agriculture is more and more dominated by externally constituted power influences of policy makers, retail traders and organisations concerned with research and certification. Although the interviewed members are aware of this tendency, they do not yet have strategies and solutions to solve the organic community members' dilemma: They wish to regain the formerly existing self-determination, but at the same time are dependent on external support. In order to re-establish successful transdisciplinary knowledge co-production among the actors of organic farming, the former processes of knowledge co-production and the related experiential and practical knowledge should be reinforced and re-assigned with power in future organisation processes of knowledge co-production in organic agriculture, and sustainability science in general.

To conclude, the present study suggests two options, which should help to overcome the above mentioned dilemma. Firstly, research relating to the further development of organic agriculture must shift from overemphasising the focus on sectoral or rather isolated problems that tend to represent interests of external actor to a transdisciplinary approach of knowledge co-production. This implies that the process of defining problems to be addressed requires the consideration of the principles, roles and responsibilities of farmers at the one hand, and scientists, policy makers, consumers and retailers on the other hand, by following the principles of transdisciplinary research approaches, that means for example interdisciplinary research methods, the integration of academic and non-academic knowledge and actors, and joint collective action. Secondly, in order to re-establish more equal power relations between the core actors of organic agriculture, i.e. farmers, committed scientists, extension agents and consumers, and external actors, institutions involved in research on organic farming should rely on co-management including more participatory and democratic forms of knowledge production and thus more balanced *legitimate, reward, coercive, referent* and *expert power* relationships.

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APPENDIX

Qualitative research methods

The present study is based on qualitative research methods which involved the following steps: formulating the research question and hypotheses; describing theories; sampling process; collection of data; coding of data; data interpretation and evaluation, presentation of research findings, with interdependence between the individual parts.

The formulation of the research question depends on the general thrust of the study, i.e. the investigation of power relationships between the actors of organic agriculture and in what way they influence the process of knowledge co-production (see introduction to this paper).

The sampling process of the study is based on critical case sampling (Flick 2007), that means to select critical cases in which the relations to be investigated become especially clear. In our study these critical cases are the experience and knowledge of pioneer farmers and of representatives of organic research and extension institutions and organisations, such as researchers involved in the development of FiBL or the president of the Swiss organic farming association. We selected key actors who have specific knowledge about one or several periods of the organic movement in a way that all historical periods and different actor groups (farmers, scientists, extension agents) are addressed by several interviewees.

The data collection is based on document analysis and semi-structured interviews. We have analysed articles about the development of organic farming and the knowledge exchange between science and farmers, historical documents as for example the organic farming journals ('Demeter') and other source materials dealing with the organic movement, for instance farming instructions. Moreover, we have defined semi-structured interview guidelines including questions referring to our specific research objectives, mainly concerning the interviewees' perception of the history of organic farming, the exchange and interaction with other actors groups in organic agriculture, the relationship between science, practice and extension services, and the influence of external institutions and actor groups on organic farming. The interviews were introduced with open questions, which generated rather long narratives. Then, we asked more concrete questions relating to the more specific issues mentioned above. The interviews have been digitally recorded.

The data processing involved transcription and thematic coding of the interviews (Strauss, 1999). We defined thematic categories related to our research objectives as a basis for the coding process. Then, the coded data has been evaluated. The data evaluation and interpretation were supported by the theoretical framework of power as presented in this paper. The interview quotations in the text have been translated from Swiss German into English.



Article III

The Influence of Institutionalization on Collaborative Knowledge Production in the Development of Organic Farming in Switzerland

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The influence of institutionalization on collaborative knowledge production in the development of organic farming in Switzerland

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Abstract

The present paper analyses the process of institutionalization of the organic movement and its influence on knowledge co-production in the future development of organic farming. The history of organic farming is comparable to the evolution of a social movement that involves societal and political recognition and corresponding institutionalization processes on the one hand, and - along with this - the loss of some of its original ideas on the other. These processes have been observed in organic agriculture in other countries, and in environmental movements in general. The views and visions of the key actors interviewed about the current situation reveal that although institutionalization is basically a positive development and constitutes a success, it has nevertheless meant a loss of collaboration in knowledge co-production between the different actors in organic farming. At the same time, growing conventionalization in organic agriculture has been observed, which leads to a loss of sustainability. The actors interviewed were concerned about the decrease of knowledge exchange and the decline of original ideas and philosophies. Based on critical investigation, the article recommends that –initially active joint knowledge creation should be re-intensified by means of concepts of transdisciplinarity. However, this must be done in a way that suits the context of today’s institutional framework conditions, which is quite different from the early phase of organic farming.

Keywords: organic agriculture, institutionalisation, transdisciplinarity, knowledge co-production

1. Introduction

Numerous scientific studies worldwide have demonstrated the advantages and benefits of organic farming as an essential form of sustainable agriculture. Organic agriculture shows significant positive impact on biodiversity and soil fertility (Hole et al., 2005; Fuller et al., 2005; Macilwain, 2004; Mäder et al., 2002). Analyses reveal for example that organic cultivation entails on average 30% to 50% more species of flora and fauna than conventional land cultivation (Bengtsson et al., 2005). Recently also a mechanism has been identified which explains in what way organic agriculture supports biodiversity: the prevention of nutrient enrichment by fertilizers in organic farming avoids the biodiversity loss caused by eutrophication through the decrease of light reaching the grassland understory (Hautier et al., 2009). Organic food production involves also various benefits to human health. For instance, while better taste is difficult to quantify scientifically, the advantage of the absence of known unhealthy components like residual antibiotics, growth hormones, or pesticides in organic food is obvious since these are not used in the organic production chain. There are quite consistent findings that organically grown vegetables contain less nitrates and more ascorbic acid (vitamin C) than those which are conventionally produced (Magkos, 2003; Williams, 2007). Moreover, concerning the problem of global warming, organic farming supports fixation of carbon or CO₂ respectively in soil, and thus, along with less energy use than conventional agriculture, helps to mitigate climate change (Chen et al., 2006; Fliessbach et al., 2006).

Since the 1990s, with the growing global concerns regarding sustainability and ecology in societal and political discussions, due to the above mentioned advantages organic agriculture has gained importance in agricultural policy. While for decades agriculture policy focussed on raising productivity and production, it has become clear, that this view has insufficiently accounted for impacts to the environment, human health and social well-being (Waltner-

Toews and Lang, 2000). Thus, important aspects of organic agriculture are social and economical needs of farmers, which involve that the market (supply and demand) is not the only factor in the determination of prices and incentives. Against this background, organic farming inevitably requires to address societal and political issues that transgress the boundaries of a purely natural or economic science perspective (Rist, 2003). Thus, beyond the questions of how agriculture and food production can become more environmentally friendly within the framework of current socioeconomic conditions, one has to ask in what way societal and political changes can be induced in order to support the development of organic agriculture.

At the beginning, the organic movement was constituted without formal structures by organic pioneers, and was rather marginalized by society, science, and the political and economical world, which produced a strong internal cohesion and mutual intellectual integrity within the organic community. The growing awareness of the emerging ecological and environmental damages in the 1970s and 1980s, like for example loss of biodiversity as well as water, soil and air pollution, and the related environmental activism and academic critique, has raised society's interest in ecological ways of food production and farming. At this time organic farming has undergone first steps of formalisation, by the establishment of an independent research institution for organic farming in 1974, the formulation of production guidelines in 1980 and by the foundation of the organisation of Swiss organic farmers in 1981. An emerging engagement of the market and the government, for instance shown by retailers' introduction of organic labels or governmental incentives, has supported the expansion of organic agriculture. Since the 1990s, more institutional structures have emerged, as for example specialized research in governmental research institutions, the introduction of governmental incentives and

regulations on the political level, intensified marketing of retail traders on the economic level, as well as enhanced specification of organic guidelines and control activities.

This development of organic agriculture can be compared to a social movement, which can be described as a network of individuals, groups or organisations, engaged in political or cultural issues on the basis of shared collective identity (Della Porta & Diani, 2006). Social movements are an increasingly prominent feature of rural politics and social action attracting growing attention of researchers in the field of rural studies and sustainability research (Woods, 2008). The present paper particularly focuses on the aspect of institutionalization, which is an inherent feature of social movements (e.g. Brand, 1999; Coglianese, 2001; Seippel, 2001; Doyle, 2005). In scientific literature, institutionalization has been described with focus on different aspects, for example on professionalization or formalization. While professionalization relates to the introduction of paid employees, of bureaucratic rules or the takeover of functions by the government (e.g. Staggenborg, 1988), formalization is connected to routines, regulations, and norms, but also cognitive factors (e.g. Seippel, 2001). Following Michelsen (2001) and Seippel (2001), in this study we define institutionalization as changes in the organisation of the social, political, economical and/or scientific system from unstructured forms into established and organised structures and/or formal regulations.

During its development the organic farming movement has undergone processes of institutionalization, which involved – as described above - the foundation of a research institute for organic agriculture, the formation of cultivation and marketing organisations, the definition of labels and guidelines, the introduction of governmental incentives for ecological farming, and the growing acceptance in society, policy and in common retail trade. Such institutionalization processes are on the one hand positive consequences of the original initiatives and the efforts to establish organic principles by the organic pioneers. On the other,

they led to new institutional structures and forms of control that had inhibiting impact on the routines and ideas, which were successful in the initial phase of organic agriculture. This dilemma has been described by several scientific studies relating to various countries, as for example Denmark (Kaltoft, 2001; Michelsen, 2001), Germany (Gerber et al., 1996; Lehmann, 2005), Ireland (Tovey, 1997), Australia, and New Zealand (Lyons and Lawrence, 1999). Aeberhard and Rist (2009) have observed this dilemma in the development of organic farming in Switzerland and analysed it with a special focus on different forms of co-production of knowledge and its correlation to principles of transdisciplinarity, which are an essential basis for the successful development of organic farming in Switzerland. At the beginning of the organic movement in Switzerland cooperation and exchange between organic pioneers includes unique forms of collaborative knowledge creation between farmers, scientists, extension agents and other concerned actors. This knowledge exchange in organic farming is fully in accordance with many basic characteristics of transdisciplinary knowledge production (Vogl and Vogl-Lukasser, 2003; Aeberhard and Rist, 2009). Thus, knowledge production in organic agriculture seems to be a successful case of transdisciplinary interaction, although these principles of transdisciplinarity were not explicitly applied.

Previous research findings affirm that transdisciplinary knowledge production between practice and science are essential for the solution of sustainability problems (Grunwald, 2004; Cash et al., 2006; Luks und Siebenhüner, 2007) and is also crucial for the further development of organic farming (Gerber et al., 1996). Concepts of transdisciplinarity involve the inclusion of members and their knowledge systems from scientific and non-scientific communities (Nowotny et al., 2002; Clark and Dickson, 2003; Cash et al., 2006) working jointly to solve a real-world problem (Klein et al., 2001). Furthermore, transdisciplinarity implies the search for a unity of knowledge beyond disciplines (Hirsch Hadorn et al., 2006;

Wiesmann et al., 2008), and breaks – in the concept of ‘strong’ transdisciplinarity - with the assumption of a single reality (Max-Neef, 2005). The development of strategies for establishing successful forms of transdisciplinary knowledge production is essential for the future development of organic agriculture.

Although it became common to measure the progress of organic agriculture in terms of the size of cultivated area or market volumes, it is important to keep in mind that behind such positive trends there is a network of engaged persons for instance from consumer and farmer associations, small to large retailers, environmental groups, fair trade organizations, researchers and groups of policy makers etc. Therefore, it is important to consider the perspectives of committed persons in order to obtain a comprehensive view regarding the development of strategies for the future development of organic farming. In this sense, the present study analyses the interviewed actors’ statements implicitly or explicitly referring to the institutionalization processes of organic farming, where they see major weaknesses in these processes and which future challenges can be derived from them. Furthermore, the present paper investigates in which way the process of institutionalization has an influence on collaborative production of knowledge, with the objective of making suggestions concerning joint knowledge creation, to which the community supporting organic agriculture could relate more systematically in future.

This paper first describes the methodological framework of the study. Then, we will present the interviewed actors’ views and attitudes referring to institutionalization processes of organic farming. This is followed by the critical analysis of the empirical material and a discussion concerning the possible influence of institutionalization processes on transdisciplinary knowledge production and its further development.

2. Methods

The study is based on qualitative research methods and involves the following steps: formulating the research questions, describing theories, sampling process, collection of data, coding of data, data interpretation and evaluation, and presentation of research findings, with interdependence of the individual parts. As follows these methodological steps of the present study are briefly described. The formulation of the research question depended on the general thrust of the study, i.e. the investigation of the views and visions of the actors of organic agriculture with regard to the future development of knowledge co-production in organic farming and institutionalization processes. The sampling process is based on critical case sampling (Flick, 2007), that involves the selection of critical cases in which the relations to be investigated become especially clear. In our study these critical cases are the experience and knowledge of pioneer farmers, policy makers, and representatives of organic research and extension institutions, and organic farming associations. In order to obtain adequate knowledge of the empirical material the data collection is based on a triangulation method using three different qualitative techniques of data collection: document analysis, the semi-structured interviews, and direct observation and participation. We have analysed relevant literature and research articles on (the history of) organic farming and knowledge exchange between scientists and farmers. Moreover, we have performed eighteen semi-structured interview guidelines including questions referring to our specific research objectives, mainly concerning the interviewees' perception of the history and future of organic farming, the exchange and interaction with other actors groups in organic agriculture, and the relationship between science, practice and extension services. The interviews were introduced with open questions, which generated rather long narratives. Then, we asked more concrete questions relating to more specific issues. The interviews mostly lasted several hours and have been digitally recorded. The interview quotations were translated from Swiss German into English.

Regarding direct observation and participation it was most interesting to have the chance of getting to know actors' farms and farming techniques directly by the farmers which gave me most interesting insight in their practices; also through attending seminars and workshops together with organic actors I became aware of how difficult it is to establish cooperation between people and institutions of different backgrounds and fields of interest. The data processing involved transcription and thematic coding (Strauss, 1999) of the interview data. As a basis for the digital coding process we defined thematic categories related to our research objectives. Then, the coded data has been grouped into clusters. These clusters have been condensed to the four topics, which are represented in the results section below.

3. Actors' views of organic agriculture and their relation to institutionalization

This section presents actors' statements which implicitly or explicitly relate to institutionalization phenomena. The corresponding data have been extracted from the thematic category concerning the actors' views on the present state and the future development of organic agriculture, since the present study investigates the present situations and corresponding problems of organic farming in order to derive suggestions for the future development. The examination of the data reveals four main topics: the importance of the basic principles of organic farming; research and research funding; requests concerning policy; and dealing with market and consumer demands. These four aspects are presented below and indicate the interviewees' corresponding opinions and concerns in relation to institutionalization processes. All quotations are from the interviewed key actors of organic farming, assigned to the groups of farmers, extension agents, and scientists. The interpretation of this data with regard to co-production of knowledge in organic farming is assessed in the discussion section of the present article.

3.1 The importance of basic principles of organic farming

The data shows the general concern of all interviewees that nowadays the members of the organic community do not hold anymore the same pioneer attitude and spirit, which were present at the beginning of the organic movement. There is also less discussion about the basic ideas and original principles of organic farming. Especially the understanding of nature, its systems, processes and comprehensive interrelations seem to have lost importance among actors of organic farming. An interviewee puts it in the following words: *„I have the feeling that organic farmers should get back their former pioneer attitude. They should be curious again to understand and incorporate the interrelations and vitality of nature”* (extension agent, 2007). This statement relates to the fundamental dilemma of an institutionalization process - namely the loss of the original philosophical basis as the price for successful establishment of institutional structures - and at the same time expresses the actors' regret of this evolution. An important consequence of the integration of organic farming in institutional incentive systems is that many farmers have changed to organic agriculture due to economic rather than philosophical reasons, mainly because they receive governmental incentives for the ecological benefits of organic agriculture, and because organic products achieve higher prices: *“Today there is kind of a turning point. Many, almost too many [farmers] have shifted [to organic farming], because they get money and more incentives for conversion. They are sometimes not very committed to organic farming, that's somewhat strange, isn't it? They use huge tractors on their fields and somehow don't have the feeling for the soil. In former times this was very different. At that time only those did organic farming, who were really convinced”* (farmer woman, 2008). Many of these farmers do not particularly focus on the original idea that a farm is seen as part of a holistic natural system, but rather on farming according to the official guidelines to get an organic label for their products with minimal efforts: *“I suffer, if farmers change to organic farming and then push to lower the guidelines, so that they only have to comply with the least possible regulations”* (farmer, 2008). The

following statement, which originates from the sector of organic animal health, shows that the economic institutionalization may lead to a gradual adjustment of organic farming towards conventional agriculture: *“What’s the point of breeding animals who perform more and more in shorter and shorter periods of time, but then are worn out very quickly? Cows and pigs have to be slaughtered after two or three reproduction cycles, without ever having the chance of becoming mature. This is the situation we have today in keeping farm animals. We also find this in organic farming. Animals of organic farming do not get much older than in conventional farming. It is an important task to bear in mind to give animals more time, and allow them to perform better over a longer period in good health and longer lifespans. What happens in organic farming approaches the exploitation observed in conventional farming. We do the same thing in a soft mode”* (scientist, 2007). This tendency towards a conventionalization of organic food production is strongly regretted by committed farmers who follow the intrinsic and original way of organic farming. Also the production of UHT milk and white flour, which both *„have nothing more to do with original organic ideas“* (scientist, 2007), contradicts the idea of natural, healthy food and represents an adaptation to the conventional range of food supply: *“‘Organic’ means ‘living’ indeed. And if you take this seriously, there is no organic white flour, because it is not only of no value, but also makes you sick. Refined sugar cannot be organic, it should only be sold with a tag for toxic substances”* (farmer, 2007). Some markets declare a product as organic, as long as it consists of organic basic components, irrespective of the consideration whether the processing corresponds to the original organic principles or not.

A further institutionalization process concerns certification procedures, control mechanisms, and a huge amount of information that has to be taken into account by the farmers: *„Every year a huge folder is published containing descriptions of new types and varieties which are for example more resistant to diseases. And there are also a lot of new findings, and one has*

always to be up to date. (...). There are also many organic plant protection products, but they change constantly. Here we have to pay extremely attention that we don't do anything wrong" (farmer woman, 2008).

3.2 Research and research funding

The actors' statements concerning knowledge production reflect the institutionalization of research. All participants except of two farmers address research and/or research funding as an important topic, twelve out of eighteen interviewees implicitly or explicitly request more collaboration between science and practice in research processes. The planning and undertaking of projects should include farmers and their experiential knowledge, and consider the applicability of research results. Research on organic farming should tackle long-term problems, address broad and comprehensive interrelations of the organic system, and not only aim at technical details. The growing influence of traditional scientific institutions and their ways of thinking has lowered the importance of farmers' practical and experiential knowledge, which has been the basis of the initial development of organic farming. Farmers should rely more on their instincts and try to (re-)establish their practical knowledge: *"There is a lot of experiential knowledge, or rather, there was a lot of experiential knowledge. It is used less and less. Much of this knowledge is not written down, and it is difficult to back it up. It is urgent that we use this enormously valuable knowledge in order to pass it on to further generations"* (extension agent, 2008).

One mentioned problematic point of institutionalization concerns the organisation of research structures: researchers tend to focus on their own interests, namely scientific publications, rather than on the applicability of research results and collaboration with farmers: *"Scientists always have to publish in research journals, and there you only get in, if it is absolutely scientific. But for farmers this is not relevant"* (farmer, 2008). Farmers need solutions adapted

to the specific environmental and regional conditions of their farms. Research results developed on an independent scientific level without the consideration of these conditions often do not provide adequate solutions to farmers' specific problems. The development of suitable solutions needs collaboration with farmers: *"They [researchers] certainly have to make experiments on their test areas, detached from practice. But afterwards, it is the task of every researcher of any kind of research area to go into the practical field"* (farmer, 2008). A consequence of institutionalization of research seems to be the sometimes missing interest of scientists in application of research results, which is linked with the loss of their direct involvement in the organic farming practice.

In contrast to most mainstream scientific institutions, the Research Institute for Organic Agriculture FiBL actively performs on-farm research and cooperates with farmers. However, the collaboration with farmers could still be improved: *"It has been suggested to FiBL to increase practice-oriented research again, which is also interesting for us [farmers], and not to do research on things to which we don't have a relation. But in comparison with other research institutes in Switzerland, FiBL is the closest to the practice"* (farmer, 2008). At FiBL there is still enough connection to the organic philosophy so that the common impact of institutionalization, namely the loss of the original basis, is reduced.

The statements concerning research funding relate to two aspects of institutionalization. On the one hand, they refer to the above-mentioned request for research with practical relevance. A major measure requested by the actors is the intensification of (research funding for) collaborative research which include farmers and their problems into research projects. On the other hand, established research funding institutions are asked for increased financial support for research on practical problems. Mostly, funding for agricultural research is directed to fundamental research, which aims at publications in international scientific journals.

Although scientists may take notice of practical farming problems, they often will not get funding for practice-oriented projects: *“It is important to do research on practical problems and not to focus on topics which promise the submission of a scientific paper to ‘Nature’. I’m upset that most of the money is spent for the latter, while the research institute FiBL, which performs practice-oriented research on-farm and in laboratories, has a lack of money”* (female policy maker, 2008).

3.3 Policy

All interviewees mention political issues, eight out of eighteen refer to the future vision of an ‘organic country Switzerland’, six address education. One of the main wants concerning the political system is long-term planning of agricultural policy and more focus on sustainability of land use and livestock farming. The usual short-term scheduling by policy and economy is not adequate to the original organic aim of growing and producing high quality goods, which prefers long-living and healthy plants and animals with optimal performance, and not short-living and overbred organisms with maximal output: *“In nature there are limits. Organic farming aims at optimal and not at maximal yields. Regarding animals it is the same. If a cow produces 6000 litres of milk we are more than happy. But today they want 8000 to 10000 litres on average”* (farmer, 2008). The integration of organic farming issues in the political system which rather focuses on short-time planning, leads to a decrease of sustainability.

One consequence of institutionalization which is perceived as negative is the influence of agricultural policy on organic farming. Conventional agriculture has much more influence in policy, which leads only to weak support of organic farming on the one hand, and on the other hand to a lowering of the organic guidelines, as for example the governmental permission of partially organically managed farms, which gives to conventional farmers the possibility to benefit from better prices and governmental incentives without having to follow original

organic principles, and against the will of the umbrella association of Swiss organic farming organizations (Bio Suisse) and organic farmers in general.

An interesting evolution, which might reverse the conventionalization trend to some degree, is the development of conventional agriculture towards genetic engineering and the use of crop yields for biomass fuel production. Some actors suggest that this might induce a recovery of the importance of organic farming as an alternative to mainstream agriculture.

The widespread diffusion of genetically engineered plants and biomass fuel plant cultivation could lead to similar problems as caused by the industrialization and the extensive use of chemistry in agriculture: *“But if genetic engineering becomes more and more important, it could end up badly. Plants will not have the chance of a long-term adaptation process, climate change will increase, and pesticide resistant plants will prevail”* (scientist, 2007).

Organic farming could be a solution to address such upcoming problems: *“If organic farming succeeds in providing reasonable solutions for the imminent collapse due to the conventionalisation, it could significantly contribute to solve societal problems, as it has already done in the 1970s”* (scientist, 2007).

The idea of an ‘organic country Switzerland’, which has been launched by Bio Suisse and means that the main part of Swiss farmland should be cultivated organically would represent a major advancement of institutionalization. However, although this might be seen as a huge success of the organic movement, the corresponding opinions of the interviewed actors are mixed. The different opinions refer to diverse advantages and disadvantages of this aim.

Although the idea is mainly considered as a good vision, the achievement of an ‘organic country Switzerland’ should not go along with a lowering of guidelines and quality standards and a loss of the precious and valuable original principles of organic farming: *“If organic farming really is better than conventional farming, it will expand. But to achieve an ‘organic*

country Switzerland' which has nothing to do with the original organic idea anymore would be an own goal" (farmer, 2007). A large expansion of organic farming might also involve a higher supply of organic products than the corresponding demand, and lead to a consequent price decline and to economical problems for organic farmers. However, under the condition of keeping high quality, ethical standards, and prices an 'organic country Switzerland' seems to be an illusion.

Moreover, the actors propose that organic farming ideas, methods, and principles should be stronger incorporated into agricultural education and further training of organic as well as conventional apprentices and farmers. Such an education would ensure that all farmers are well acquainted with the original organic approaches and their advantages and requirements. This would involve an enhanced institutionalization of organic farming on the educational level.

3.4 Addressing market and consumer demands

Ten out of eighteen participants emphasize the growing influence of market issues which are the result of the enhanced establishment of organic farming in market structures. As a consequence, organic farmers more and more have to respond to the demand of consumers, on the one hand, due to the fact that a large part of organic products is sold through big retail companies (mainly Migros and Coop), but also in direct marketing: *"Also organic products are subjected to the trend towards more convenience products and therefore to market pressures. On the other hand, there is a general demand for regionality, authenticity, or specialty of a product"* (farmer, 2007). Consumers may expect to get peppers, oranges, and other sorts of vegetables and fruits at any time of the year. Thus, farmers may feel forced to sell products, which they have not produced themselves.

However, there are some farmers who have escaped these influences by direct marketing or cultivating niche products, and thus being more independent of the general market pressures. Also in general, compared to conventional agriculture, organic farmers have kept some independence as they do not depend on the purchase of synthetic fertilizers, plant protecting agents, specific seeds, and thus on the big agro industry groups: *“Organic farming is indeed independent from agro industry companies. I really enjoy that I can complain about Syngenta as much as I want, because I don’t use any product of Syngenta on my farm”* (farmer woman, 2008).

Some actors mention a possible way which might allow to counteract the negative aspects of market demands: the better information of consumers about the advantages of organic food, as for example the positive influence on human health, less energy use, or the possibility to mitigate climate change: *“The expansion of organic farming would inhibit the consumption of hundreds of thousand tons of petroleum, because no artificial fertilizer would have to be produced. We contribute to save fossil fuels. Apart from that, due to soil organisms and the abandonment of chemical weed killing, more CO₂ remains in organically cultivated soil. This should really be more promoted in the political world”* (farmer, 2007). Such marketing and information efforts should enhance the understanding of consumers and their willingness to pay a higher price for organic products. They might also help consumers to focus on more seasonal and regional products, which is another aim of organic and sustainable agriculture respectively. In addition, the disadvantages of conventional food production, such as high energy use, heating of greenhouses, long distance transports, or the use of fertilizer and pesticides, could also be more communicated in public. Clients should be better informed about the problems of intensive livestock farming and the often inadequate keeping of animals.

4. Discussion: Institutionalization processes and co-production of knowledge

The analysis of the data has clearly shown a number of key aspects of institutionalization of the organic movement, namely changes in the organisation of the social, political, economical and scientific system from unstructured forms into established and organised structures and/or formal regulations as defined in the introduction, along with the increasing acceptance in society, economy and science. The common dilemma of the loss of the original ideas going along with institutionalization of social movements as described in the introduction is a major aspect that is often directly addressed and strongly regretted by the interviewees. The decrease of the importance of the original philosophy is put in relation to a growing conventionalization of organic agriculture and a consequent loss of sustainability, and thus to a decline of a major aspect of the original ideas. Further institutionalization processes addressed in the actors' statements concern the increased economic thinking including the short-term focus of policy; the production of conventional products as for example UHT milk; certification and guidelines; the influence of agricultural policy in connection with a lack of participation possibilities; and the dependence on market and consumer demands.

An important effect of institutionalization of science in organic farming is seen in the loss of importance of experiential knowledge in research and the increasing significance of mainstream research. While the negotiations of the concerned actors with the corresponding communities and authorities led to the institutionalization of parts of their ideas on the political, economical and scientific level, the very precious processes of collaborative knowledge production, which were prominent and successful in the initial phase of organic farming, have not been institutionalized. The loss of the former valuable forms of knowledge exchange between farmers and scientists is regretted by the actors and should in their opinion be reactivated. We will come back to that later.

An enhancement of institutionalization is seen generally as positive, if it concerns either the expansion of the organically cultivated area and market share, as for example an ‘organic country Switzerland’, which aims at a predominantly organic cultivation of agriculture area in Switzerland, or the diffusion of organic ideas, as for instance the integration of courses on organic farming into the general agricultural education. The demand for funding from governmental institutions shows on the one hand the actors’ appreciation of the possibility of support by governmental institutions, but on the other hand the problem that these institutions do not entirely come up to the wants of the organic actors, as for example too little support for practice-oriented research. The example of FiBL shows that it is possible to realize institutionalization – here relating to research – without the common loss of the original ideas. Moreover, there are also ideas that might help to reverse effects of institutionalization which are considered as negative by the interviewed actors: the pressure of market demands could be lowered by better information of consumers about the advantages of organic farming.

In the following paragraphs we concentrate on the influence of institutionalization on knowledge co-production and the possibilities to reverse the observed consequences. The clear request to restore the collaboration in knowledge co-creation does not only represent the opinion of the majority of the interviewed actors, but is supported by scientific findings that transdisciplinary knowledge production between practice and science are essential for the solution of sustainability problems, as outlined in the introduction. In addition, the importance of the inclusion of farmers’ and local experts’ knowledge has also been emphasized by many studies in several geographical regions, as for example in Europe (Wiek, 2007), East Africa (Ondura and Du Preez, 2008; Isselstein and Maass, 2006) or Australia (Millar and Curtis, 1997). We analyse the influence of some aspects of institutionalization discussed above on

knowledge co-production and discuss possibilities for a future development in a sustainable way.

The evaluation of the data with regard to the influence on knowledge co-production reveals three significant fields, which are presented in the following sub-sections.

4.1 Inclusion and recognition of experience-based knowledge

The institutionalization of research in organic farming in Switzerland has led to a strong decrease of knowledge co-production of organic farming, as has been shown by Aeberhard and Rist (2009) and has been pointed out by the interviewed actors. One of the major topics mentioned by the actors explicitly addresses the support of collaborative production of knowledge, in particular the stronger inclusion and recognition of farmers' practical and experience-based knowledge. This aspect has been lost with increasing influence of traditional scientific institutions and their approaches and interests. While the actors see potential for improvements in mainstream agricultural research institutions, they appreciate and acknowledge the efforts of the organic research institution FiBL to include farmers by carrying out on-farm research projects. However, involving farmers' knowledge in research planning and projects could be further improved. The corresponding challenge to consider and include actors', mainly scientists' and farmers', different ways of thinking, is one of the central tasks of transdisciplinary research projects, which has been shown in various assessment studies (e.g. Burger and Kamber, 2003; Blättel-Mink and Kastenholz, 2005; Eshuis and Stuiver, 2005; Zierhofer and Burger, 2007; Hoffmann et al., 2009).

Another important problem is that funding agencies prefer fundamental research resulting in high-profile publications, which mainly address very detailed issues of methods or processes. Researchers and scientific institutions only can perform problem-oriented research, pursue

holistic approaches, and comprehensively investigate system interrelations, if they get the funding for corresponding projects.

Summarizing, the support of transdisciplinary knowledge production needs the readiness and the engagement of researchers to include farmers into the research process, the effort and willingness of farmers to use existing and upcoming opportunities to be active in transdisciplinary research (Reimer, 1996; Hoffmann et al., 2009), and the supply of sufficient financial resources by funding agencies and government

4.2 Focus on original organic ideas

A second main aspect and a critical effect of institutionalization of the organic movement are less pioneer attitude of the farmers and a decrease of their interest in the original worldviews of organic farming. Although the influence of this aspect on knowledge production seems not obvious, dealing with the original organic ideas and principles has an enabling influence on collaborative knowledge production (Aeberhard and Rist, 2009) and is considered as most essential for the future development of organic agriculture. The today observed trend goes towards a conventionalization, as for example the introduction of organic UHT-milk or a bigger focus on yield maximization. In order to reverse this tendency, marketing efforts should be based on products according to the basic organic principles and aim at an expansion of organic agriculture without conventionalization. This is also in line with Johnson (2006), who states that in order to successfully approach sustainability, forms of agriculture which correspond to high sustainability standards, as for instance organic farming, are more adequate than a modification of conventional farming. Therefore, the original ideas of organic agriculture, as for example the understanding of a farm and of nature as holistic systems, should re-gain their initial importance and attention. An intensive discussion of the organic

principles is an essential basis for the continuation of organic agriculture and would significantly contribute to a re-stimulation of transdisciplinary knowledge production.

4.3 Certification procedures

A third effect of institutionalization is a growing set of guidelines and control mechanisms, which are often defined without the input of farmer's experience and knowledge (Vogl et al., 2005). This continually further specified set of regulations and guidelines defined by organic certification institutions and the government, as well as the related controlling procedures involve that farmers use much of their precious working time for verifying the compliance of their products and production processes with these guidelines. Farmers are generally annoyed by the complexity of regulations. The controlling mechanisms reduce time that has previously been available for cooperation and knowledge exchange within the organic community.

However, the actors wish that guidelines should not be lowered and adjusted to conventional practices, which would diminish the core idea of organic agriculture. Controlling procedures should rather focus on a farm as a whole instead of checking a lot of numbers and details. A more comprehensive controlling approach would allow farmers to deal more with basic organic ideas, which in turn would be a good basis for a successful contribution to co-production of knowledge.

5. Conclusion

The analysis of statements by the interviewees of the present study shows patterns of institutionalization processes and its effects: a gradual loss of the importance of the basic organic principles and a decrease of the intensity of knowledge co-production in organic farming. This tendency as well as the emerging trend towards a conventionalization of organic farming jeopardizes the successful further development of organic agriculture and its philosophy, and at the same time might endanger the high sustainability level which is an

essential advantage of organic agriculture. The reversal of this development would be appreciated by the majority of the participants of the study and corresponds to a general requirement for the solution of sustainability problems as described in the scientific literature (see above). Such a reversal comprehends the re-establishment of the basic characteristics of organic farming, in particular its holistic understanding of nature-related and sustainable farming methods. The data evaluation leads to the following ideas which might help to achieve this goal:

- *The enhanced consideration of farmers' experience-based knowledge into research:* this is a very important aim, which involves the commitment and readiness of both researchers and farmers.
- *The reduction of time that farmers have to invest for complying with numerous detailed guidelines, and the re-defining of regulations which focus on a more comprehensive understanding of the organic system:* this would allow for more time and motivation to deal with the further development of organic farming and thus enhance the involvement in co-production of knowledge.
- *Research funding should better support problem- and practice-oriented research and acknowledge the necessity of holistic approaches,* which are fundamental for organic farming.
- *Increased lobbying in agricultural policy* in order to head for more sustainable ways of farming and food production.

While the implementation of these ideas improve the preconditions for successful co-production of knowledge between the actors of organic agriculture, the re-intensification of joint knowledge creation could be supported by the reflection and implementation of transdisciplinary concepts. However, this has to be made in a way which suits the context of

today's institutional framework conditions of organic farming. Such activities would be an important step towards a more sustainable agriculture in the future.

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Article IV

Transdisziplinäre Wissensproduktion im Biolandbau

Transdisziplinäre Wissensproduktion im Biolandbau

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Zusammenfassung

Vor allem in der Anfangsphase des Biolandbaus spielte das praktische Erfahrungswissen und die Zusammenarbeit zwischen Praxis, Forschung und Beratung bei der Wissensproduktion eine zentrale Rolle. Der Wissensaustausch in dieser Phase weist viele Charakteristiken von transdisziplinärer Wissensproduktion auf. Seither wurde das Potential der Zusammenarbeit von Praxis und Wissenschaft immer weniger wahrgenommen und genutzt. Diese Tendenz wird von der Mehrheit der im Rahmen dieser Studie befragten Schlüsselakteure des Biolandbaus in der Schweiz bedauert. Der vorliegende Bericht präsentiert Wünsche und Visionen dieser Akteure zur zukünftigen Entwicklung der Wissenserzeugung in der biologischen Landwirtschaft. Die Untersuchung zeigt, dass die abnehmende Intensität des Wissensaustauschs in Zusammenhang stehen könnte mit einem verstärkten Einfluss von traditionellen institutionellen Strukturen und dem Rückgang der Auseinandersetzung mit den ursprünglichen Ideen und philosophischen Grundlagen des Biolandbaus, die sich auf eine ganzheitlichen Weltanschauung beziehen. Im Hinblick auf eine erfolgreiche Weiterentwicklung des Biolandbaus als nachhaltige Landwirtschaftsform regt die Studie an, den ursprünglich intensiven Wissensaustausch unter den Akteuren im Biolandbau mit Hilfe der Anwendung transdisziplinärer Konzepte und Forschungsprojekte wiederzubeleben.

Biolandbau ist hoch im Trend und findet trotz Wirtschaftskrise immer mehr Abnehmer. Im Jahr 2008 stieg der Umsatz mit Bioprodukten in der Schweiz

um gut 11 Prozent an (Bio Suisse 2009) und zeigt damit die Wichtigkeit und Aktualität des Biolandbaus als eine nachhaltige Form der Landwirtschaft. Der Biolandbau hat sich von einer anfänglichen Randbewegung zu einem gesellschaftlich, politisch und wirtschaftlich anerkannten modernen Landwirtschaftszweig entwickelt, der einen wichtigen Beitrag zur nachhaltigen Nahrungsmittelproduktion leistet. Heute sind die Vorteile der biologischen Landwirtschaft wohlbekannt und wurden mehrfach, z.B. durch Mäder *et al.* (2002), wissenschaftlich untermauert. Trotzdem haben zwischen 2005 und 2007 über 4% der Betriebe den Biolandbau verlassen. Dies zum grössten Teil aus ökonomischen Gründen (Reissig *et al.* 2009), obwohl Biobetriebe gegenüber Betrieben mit ökologischem Leistungsnachweis (ÖLN) im Allgemeinen ein höheres Arbeitseinkommen erzielen (Lips und Eggimann 2007). Der vorliegende Bericht zeigt, dass in der biologischen Landwirtschaft ein Umbruch im Gange ist, der von vielen Exponenten der Biobewegung kritisch verfolgt wird. Insbesondere wird eine „Konventionalisierung“, d.h. eine Angleichung an die konventionelle Landwirtschaft befürchtet, die zu einem Verlust der Vorteile des Biolandbaus bezüglich Nachhaltigkeit, Ökologie und philosophisch-ethischer Fragen führen könnte. So werden auf Biobetrieben beispielsweise Ökomassnahmen im Vergleich zu ÖLN-Betrieben deutlich häufiger umgesetzt (Schader *et al.* 2008).

Die vorliegende Studie hat Akteure aus dem Schweizer Biolandbau unter anderem zu ihren Vorstellungen in Bezug auf die Zukunft der Biolandwirtschaft befragt. Das Projekt basiert auf qualitativen Forschungsmethoden, die einen tiefen Einblick in die unterschiedlichen Denkweisen und Wissensformen der befragten Akteure erlauben und diese adäquat erfassen können (Flick *et al.* 2008). Die Auswahl der Akteure erfolgte unter Anwendung der Critical-Case-Sampling-Methode, das heisst nach bestimmten Kriterien. Die Kriterien für die vorliegende Forschungsarbeit waren der Einbezug verschiedener Bereiche und Institutionen des Schweizer Biolandbaus aus Praxis, Forschung, Beratung und Politik. Die Auswahl brachte Schlüsselakteure

hervor, die einem oder mehreren der oben genannten Bereiche angehören und gute Kenntnisse der Geschichte und/oder der gegenwärtigen Verhältnisse im Biolandbau in der Schweiz mitbringen, so dass alle Bereiche (Praxis, Forschung, Beratung, Politik) sowie historischen Phasen vertreten waren, was für die Analyse der gemeinsamen Wissensproduktion zwischen Praxis, Beratung und Forschung in der Entwicklung des Biolandbaus essentiell ist. Die Daten wurden unter Einbezug von unterschiedlichen Datenquellen mittels Triangulation erhoben. Dieser Prozess schloss einerseits die Analyse von Dokumenten verschiedenster Art (Studien zur Geschichte und Gegenwart des Biolandbaus, Zeitschriften, Forschungsliteratur etc.), achtzehn mehrstündige, halbstandardisierte Leitfadeninterviews und partizipative Beobachtung ein. Die Interviews wurden mit offenen, erzählungsgenerierenden Fragen eingeleitet und später mit spezifischeren Fragen ergänzt. Die Fragen bezogen sich auf die Geschichte, Gegenwart und Zukunft des Schweizer Biolandbaus und auf die Wahrnehmung von Forschung, Praxis, Politik oder Beratung, je nachdem aus welchem Bereich die befragten Akteure stammten. Die Interviews wurden digital aufgezeichnet. Weiter durfte ich Akteure zu Biolandbau-Seminaren begleiten, wurde durch ihre Institutionen geführt und hatte auch oft die Gelegenheit, Biohöfe zu besuchen, was eine gute Einsicht in die unterschiedlichen Praktiken bot und eindrücklich zeigte, wie schwierig es sein kann, Kooperationen zwischen Vertreter/innen verschiedener Hintergründe und Interessensfeldern zu schaffen.

Die empirisch erhobenen Daten wurden transkribiert, thematisch codiert und geclustert sowie zu thematischen Kategorien verdichtet, die den Forschungszielen entsprachen, für den vorliegenden Bericht die Zukunftsvisionen der Bio-Akteure. Die Datenanalyse zeigt auf, dass die befragten Akteure klare Bedürfnisse betreffend der zukünftigen Entwicklung des Biolandbaus äussern. Eine wichtige Rolle spielt dabei die Zusammenarbeit in der Wissensproduktion zwischen Praxis, Beratung und Forschung sowie Innovations- und Pioniergeist, welche die Entwicklung des Biolandbaus in

der Schweiz stark geprägt haben. Dies hat auch Bundesrätin Doris Leuthard in ihrer Ansprache an der Wissenschaftstagung zum Thema ökologischer Landbau im Februar 2009 an der ETH Zürich betont: Die Schweiz sei ein Pionierland bei der Einführung des Biolandbaus; in der Praxis, am Markt und in der Forschung, und in diesem Sinne müsse es „unser Ziel sein, diese Schrittmacherposition durch Forschung, Bildung und Beratung beizubehalten und mit weiteren Innovationen in Organisation und Abläufen die gesamte Biolebensmittelkette fit zu trimmen“ (FiBL 2009). Vor diesem Hintergrund zeigt die Geschichte des Biolandbaus eine höchst interessante Entwicklung. Während die allgemeine Geschichte der biologischen Landwirtschaft in verschiedenen Studien behandelt wird (z.B. Schaumann *et al.* 2002; Vogt 2000; Moser 1994; Scheidegger 1993), beschreiben Aeberhard und Rist (2009) erstmals die historische Entwicklung der Zusammenarbeit in der Wissensproduktion zwischen Praxis, Beratung und Wissenschaft. Sie zeigen, dass der Biolandbau in der Schweiz einen sehr erfolgreichen Fall einer Innovation darstellt und im Verlauf der Zeit höchst interessante Muster von gemeinsamer Wissensproduktion aufweist. In der Gründungszeit bis in die 1970er Jahre wurde das Wissen von Bäuerinnen und Bauern, Beratungspersonen und Forschenden hauptsächlich gemeinsam produziert und an Kursen und Seminaren, wie zum Beispiel auf dem Möschberg, intensiv ausgetauscht. Das Erfahrungswissen der Bauern und Bäuerinnen bildete dabei eine essentielle Basis. Mit der Gründung des FiBL 1974 wurde zum ersten Mal ein Teil der Biolandbauforschung institutionalisiert. Es bestand aber weiterhin ein guter Austausch zwischen Forschenden und der Praxis, und es wurden immer noch Experimente direkt auf Bauernhöfen betrieben. In den 1990er Jahren zeichnet sich dann ein eindrückliches Dilemma ab: Einerseits wurde nach langem Ringen die politische und gesellschaftliche Anerkennung der biologischen Landwirtschaft als ökologische und nachhaltige Anbaumethode nach und nach erlangt. Zudem wuchsen die Absatzmärkte und es wurden staatliche Direktzahlungen für ökologische Lebensmittelproduktion

eingeführt. Auf der anderen Seite ging durch die steigende Bedeutung von ökonomischen Aspekten, Richtlinien und zunehmender Spezialisierung die Auseinandersetzung mit den grundsätzlichen Ideen der Biolandwirtschaft und das Engagement für die Wissensproduktion zurück. Dazu kam die wachsende Abhängigkeit vieler Biobauern von spezialisiertem Expertenwissen aus den etablierten Forschungsinstitutionen. Die ursprüngliche enge Zusammenarbeit in der Wissensproduktion nahm also im Verlauf der Geschichte allmählich ab (Aeberhard und Rist 2009).

Der vorliegende Artikel beschreibt zuerst die Zukunftsvisionen der befragten Akteure aus dem Biolandbau und zeigt, dass diese die Problematik der gegenwärtigen Entwicklung betonen und sich eine Reaktivierung des anfänglich intensiven Diskurses im Biolandbau wünschen. In einem nächsten Schritt wird das Konzept der transdisziplinären Wissensproduktion erläutert und dessen Bedeutung in der Geschichte und für die zukünftige Entwicklung des Biolandbaus diskutiert. Zuletzt werden Schlussfolgerungen und Empfehlungen präsentiert als Beitrag zur Förderung einer erfolgreichen und nachhaltigen Weiterentwicklung der Biolandwirtschaft.

Visionen zur zukünftigen Wissensproduktion

Die Datenanalyse hat gezeigt, dass sich die Wünsche und Visionen der befragten Akteure in vier Hauptbereiche einteilen lassen: Wunsch nach Wiederbelebung der ursprünglichen Ideen des Biolandbaus; verbesserte Rahmenbedingungen für Forschung mit Praxiseinbezug; Wünsche an die Politik; Umgang mit Markt und Konsumentenbedürfnissen. Diese vier Bereiche wurden jeweils von mindestens zwei Dritteln der befragten Akteure (mindestens zwölf von achtzehn) angesprochen und sind im Folgenden näher beschrieben sowie in Tabelle 1 zusammengefasst.

Wunsch nach Wiederbelebung der ursprünglichen Ideen des Biolandbaus: Die Mehrheit der befragten Akteure hat betont, dass heutzutage nicht mehr derselbe Pioniergeist wie in der Anfangszeit des Biolandbaus besteht

und das gesamtheitliche Verständnis der Natur mit all ihren Zusammenhängen an Wichtigkeit verloren hat, wie beispielsweise durch diese Aussage bekräftigt wird: *„Von meinem Gefühl her sollten die Biobauern wieder Wissenspioniere werden, die wissensgierig sind und Zusammenhänge verstehen wollen“* (Biopionier, Interview 2007). Wenn aus mehrheitlich ökonomischen Gründen auf Biolandbau umgestellt wird, steht die Idee des Bauernhofs als Teil eines ganzheitlichen Systems oft nicht mehr im Vordergrund: *„Ich leide darunter, dass man sagt, ich will zum Bio kommen, aber dann fährt man möglichst die Richtlinien herunter, damit man möglichst wenig erfüllen muss“* (Biopionier, Interview 2008). Diese zunehmende Konventionalisierung wird als klare Schwächung der ursprünglichen Bioidee eingestuft und sollte nach Ansicht der Befragten verhindert werden.

Verbesserte Rahmenbedingungen für Forschung mit Praxiseinbezug:
Ein weiteres Hauptanliegen der befragten Akteure ist der verstärkte Einbezug des praktischen Erfahrungswissens in die Forschung: *“Es gibt ein unheimliches Erfahrungswissen, oder: es gab ein unheimliches Erfahrungswissen. Und es wird immer weniger genutzt (...). Es ist dringend nötig, dass man das alles sicher stellt und auch für die Forschung wieder nutzbar macht“* (Biopionier, Interview 2008). Weiter wurde das Bedürfnis geäußert, dass vor allem in der Forschungsplanung die Rolle von bäuerlichem Erfahrungswissen verstärkt werden könnte. Dabei stellt jedoch die Verbindung von unterschiedlichen Denkweisen und Wahrnehmungsstilen von Forschung und Praxis eine grosse Herausforderung dar: *“Und wir (die Bauern) sind uns einfach gewohnt, ganzheitlich zu denken. Und die Forscher, die sind sich gewohnt alles aufzuscheibeln, bis sie am Schluss bei einem Stücklein sind, bei dem sie wirklich alle äusseren Einflüsse wegnehmen können. Und die beiden Sichtweisen zusammen zu bringen, ist fast nicht möglich“* (Biobauer, Interview 2008). In diesem Prozess sind von den beteiligten Akteuren besonders viel gegenseitiges Verständnis und Interesse gefordert. Zudem

wären grundsätzlich mehr Forschungsgelder für den Biolandbau – insbesondere für praxisnahe Projekte - erwünscht.

Wünsche an die Politik: Ein weiterer wichtiger Wunsch der befragten Akteure ist der Wunsch an die Politik nach einer längerfristigen Planung und einer Agrarpolitik mit starkem Gewicht auf nachhaltiger Bodenbearbeitung und Tierhaltung im Sinne von hohen Qualitätsrichtlinien. Langzeitplanung ist für Bauern enorm wichtig, da der Anbau landwirtschaftlicher Produkte nicht kurzfristig den Wirtschaftsbedingungen und Konsumentenbedürfnissen angepasst werden kann.

Umgehen mit Markt und Konsumentenbedürfnissen: Der steigenden Nachfrage nach dem gesamten Gemüseprogramm in allen Jahreszeiten könnte mit besserer Information der Konsumentinnen und Konsumenten über Energieverbrauch, Transportwege und Kosten der außersaisonalen Produktion begegnet werden. Der Druck zur ständigen Anpassung an die Bedürfnisse der Abnehmer erhöht den Aufwand für die Biobauernbetriebe und beansprucht zeitliche Ressourcen der Bauern und Bäuerinnen, die dann fehlen für die Auseinandersetzung mit der ursprünglichen Idee eines ganzheitlichen natürlichen Systems. Dies wiederum schwächt auch die Möglichkeiten, sich mit der Weiterentwicklung des Biolandbaus und dem Wissensaustausch zu befassen. Das gleiche gilt für die Konfrontation mit einer zunehmenden Zahl an Richtlinien und Anforderungen, die Zeit und Energie der Bauern und Bäuerinnen absorbieren. Die Herabsetzung der Anforderungen für biologische Produkte wird jedoch nicht als Lösung betrachtet. Gewünscht wird vielmehr, dass Kontrollprozeduren vermehrt auf einen Hof als Ganzes ausgerichtet werden und nicht auf die detaillierte Kontrolle von oft als nicht relevant erachteten Einzelheiten. Dies würde mehr Zeit für gesamtheitliche Betrachtungsweisen und entsprechenden Erfahrungsaustausch schaffen.

Auf Grund der Datenanalyse kann zusammenfassend gesagt werden, dass die Mehrzahl der befragten Akteure – besonders aus der Praxis – es begrüßen würde, wenn die im Laufe der Zeit immer schwächer gewordene

gemeinsame Wissensproduktion unter Akteuren aus Praxis, Forschung und Beratung des Biolandbaus im Sinne des anfänglich erfolgreichen und engen Austauschs wieder intensiviert werden könnte. Die Studie versucht Wege aufzuzeigen, die helfen sollen, diesem Wunsch nach verstärkter Kooperation nachzukommen. Ein gutes Instrument für die Förderung einer erfolgreichen Zusammenarbeit ist die Anwendung von Konzepten der transdisziplinären Wissensproduktion. Nachfolgend wird gezeigt, was in diesem Beitrag unter Transdisziplinarität verstanden wird und wo entsprechende Zusammenhänge mit der historischen Entwicklung und der Zukunft des Biolandbaus bestehen.

Wiederbelebung ursprünglicher Bioideen	Mehr Praxiseinbezug in die Forschung	Nachhaltigere Agrarpolitik	Umgang mit Markt und Konsumenten
Bauern sollen Wissenspioniere bleiben	Vermehrte Nutzung des Erfahrungswissens in der Wissenschaft	Längerfristige und nachhaltigere Planung	Bessere Information von Konsumenten über Vorteile von Bioprodukten
Betrachtung des Hofes als ganzheitliches System	Einbezug von Bauern in die Forschungsplanung	Sicherung des bäuerlichen Einkommens	Fokus auf saisongerechtem regionalem Angebot
Vermeidung der Konventionalisierung	Berücksichtigung unterschiedlicher Denkweisen (z. B. von Forschenden und Bauern)	Kontrollen im Sinn des ganzheitlichen Systems, nicht nur Details	Erzielen von genügend hohen Preisen durch Förderung des Konsumenten-Bewusstseins betr. hoher Produktqualität
Qualität soll hoch bleiben	Mehr Mittel für praxisnahe Forschung	Keine Verwässerung der Richtlinien	Berücksichtigung, dass Anbau und Produktion von Lebensmitteln nicht dem schnell wechselnden Konsumentenbedürfnis angepasst werden können.

Tabelle 1: Kernpunkte betreffend Visionen und Wünschen befragter Akteure zur zukünftigen Entwicklung des Biolandbaus, aufgeteilt in vier Hauptkategorien.

Biolandbau und transdisziplinäre Wissensproduktion

Das als Transdisziplinarität bekannt gewordene Wissenschaftsverständnis geht nicht von rein akademisch bestimmten, sondern von gesellschaftlich ausgehandelten Problemstellungen aus. Der transdisziplinäre Forschungsprozess wird als teamorientierte Zusammenarbeit von betroffenen akademischen und nicht-akademischen Akteuren aus Praxis und Forschung verstanden. Unterschiedliche Wissensformen, natur- sowie sozialwissenschaftliche

Paradigmen und die Möglichkeit unterschiedlicher Wirklichkeitsebenen und Wahrnehmungen werden explizit anerkannt (Hirsch Hadorn *et al.* 2006; Max-Neef 2005). Transdisziplinäre Wissensproduktion leistet damit einen wichtigen Beitrag an die Nachhaltigkeitsforschung, die auf Interaktionen zwischen Natur und Gesellschaft ausgerichtet ist und nach problemorientierten und breit abgestützten Lösungen sucht.

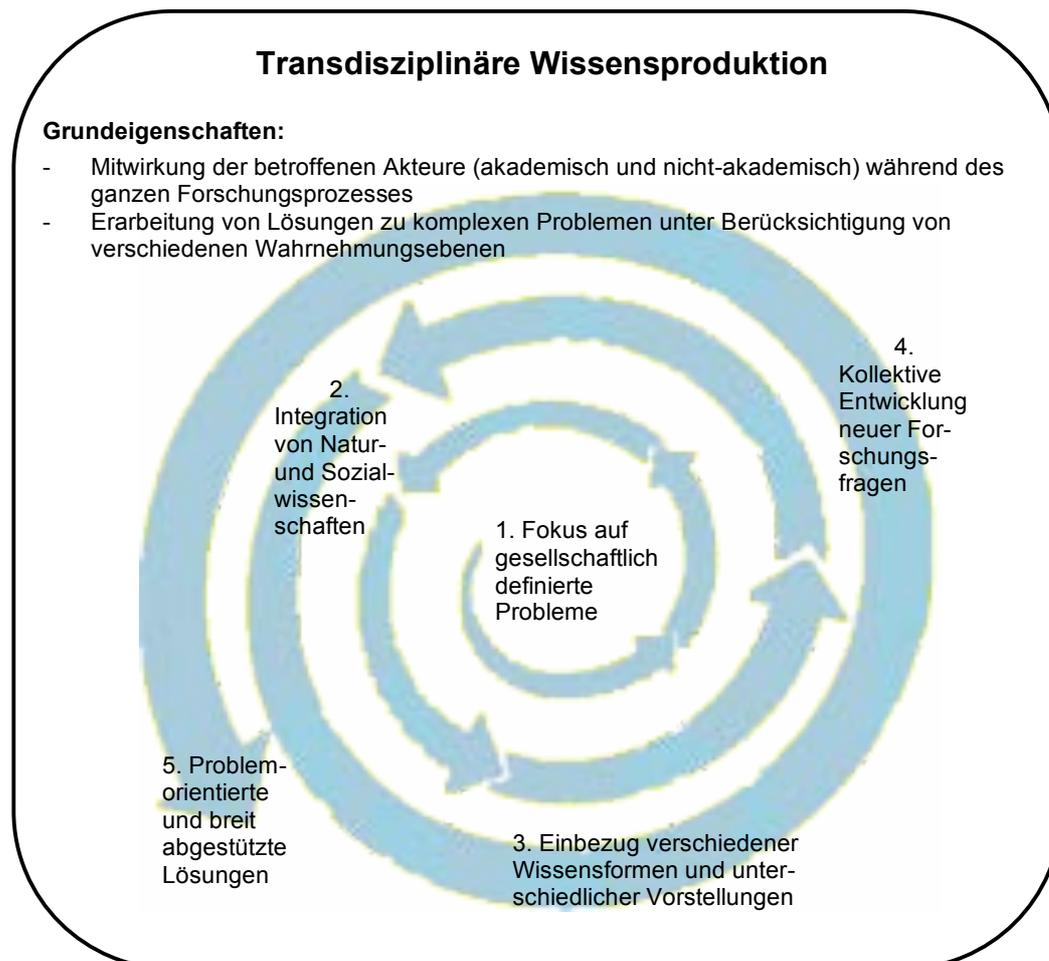


Abbildung 1: Charakteristiken von Transdisziplinarität

Die in Abbildung 1 aufgeführten Charakteristiken der transdisziplinären Wissensproduktion lassen sich vor allem in der Anfangsphase der Geschichte des Biolandbaus klar erkennen: Die Gründung des Biolandbaus war eine Reaktion auf die Folgen der zunehmenden Industrialisierung der Landwirtschaft, insbesondere die ersten beobachteten Schäden wie Bodenverdichtung oder abnehmende Nahrungsmittelqualität. Diese umwelt- sowie

gesellschaftsrelevanten Probleme wurden von den Pionieren schon früh erkannt (Abb. 1, Punkt 1). Die Auseinandersetzung mit dieser Problematik erfordert sowohl sozial- und geisteswissenschaftliche Fragestellungen, wie z.B. zum Verständnis von der Natur und Umgang mit der Umwelt, als auch naturwissenschaftliche Methoden aus Biologie oder Bodenkunde (Abb. 1, Punkt 2). Die Grundlagen der biologischen Landwirtschaft wurden auf der Basis von verschiedenen Wissensformen und unterschiedlichem philosophischem Gedankengut geschaffen, wie dem anthroposophischen Weltbild Rudolf Steiners oder der Theorie des „Kreislaufs der lebendigen Substanz“ von Hanspeter Rusch (1952) einerseits, aber auch Erkenntnissen aus der Mikrobiologie andererseits (Abb. 1, Punkt 3). Der Dialog zwischen Praxis und Wissenschaft wurde lange Zeit vor allem in Kursen und Seminaren, aber auch durch Erarbeitung neuer Methoden auf dem Bauernhof intensiv betrieben und gefördert. Die gewonnenen Erkenntnisse wurden durch die enge Zusammenarbeit laufend verbessert, und auftauchende Probleme und Fragen wurden gemeinsam bearbeitet (Abb. 1, Punkt 4). Diese Prozesse der transdisziplinären Wissensproduktion führten erfolgreich zu praxisnahen und breit abgestützten Lösungsfindungen (Abb. 1, Punkt 5). Im Verlauf der Zeit nahm die Intensität dieser anfänglich engen Zusammenarbeit immer mehr ab, sollte aber gemäss der oben beschriebenen Wünsche der befragten Akteure in Zukunft wieder vermehrt Beachtung erhalten. Im Folgenden wird diskutiert, inwiefern die Verbindung von Erkenntnissen aus der Transdisziplinaritätsforschung und aus der Untersuchung der Formen der Wissensproduktion in der Geschichte des Biolandbaus die Wiederbelebung der gemeinsamen Wissenserzeugung unterstützen könnte.

Diskussion und Schlussfolgerungen

Zusammengefasst zeigt die Studie, dass die Visionen der Mehrheit der befragten Personen allgemein mit einer verstärkten Zusammenarbeit zwischen den verschiedenen Akteurgruppen im Biolandbau in Bezug stehen.

Bisherige Forschungserkenntnisse bestätigen, dass eine gemeinsame Wissensproduktion zwischen Praxis und Forschung für die Lösung von Nachhaltigkeitsproblemen essentiell ist (Grunwald 2004; Cash *et al.* 2006; Luks und Siebenhüner 2007) und auch für die Weiterentwicklung des Biolandbaus eine grosse Bedeutung hat (Gerber *et al.* 1996). Dies zeigt, dass es auch aus wissenschaftlicher Sicht sinnvoll ist, den Bedürfnissen der befragten Akteure zu entsprechen. Ein sehr gut geeigneter Ansatz, um in die Richtung der geäusserten Wünsche zu gehen, wäre die Reflektion und Umsetzung von transdisziplinären Konzepten. Transdisziplinarität beinhaltet die Berücksichtigung von verschiedenen Denkweisen und Wissensformen und kann damit dem Wunsch nach Rückbesinnung auf die ursprünglichen Ideen, nämlich einer ganzheitlichen Betrachtungsweise der Natur oder dem Einbezug von anthroposophischem Gedankengut nachkommen. Hierbei ist ein wichtiger Ansatz, die gegenseitige Anerkennung der verschiedenen beteiligten Akteure, sei es aus akademischen oder nicht-akademischen Bereichen, und das Verständnis bezüglich der entsprechenden unterschiedlichen Denkweisen zu vertiefen, was gegenseitiges Verständnis und ein grosses Engagement der Akteure aus Forschung, Praxis, Politik und Markt voraussetzt. Insbesondere könnte auf politischer Ebene durch langfristige und nachhaltige Planung in der Agrarpolitik sowie durch die Förderung von praxisorientierter und transdisziplinärer Forschung im Biolandbau die gemeinsame Wissensproduktion unterstützt werden. Der Notwendigkeit nach vermehrtem Praxiseinbezug in die Biolandbauforschung könnte mit der Konzeptionalisierung und Umsetzung von transdisziplinären Forschungsprojekten Rechnung getragen werden. Dafür erforderliche konkrete Schritte sind unter anderem die Zusammenstellung von interdisziplinären Projektteams aus den Bereichen Ökonomie, Ökologie, Natur- sowie Sozialwissenschaften, die Suche nach Partnern aus der Praxis, die Aufgabenteilung unter den Projektpartnern und das Suchen nach einer gemeinsamen Sprache (Hoffmann *et al.* 2009).

Mit Hilfe der Erfahrungen aus der Transdisziplinaritätsforschung könnten die in der Anfangsphase des Biolandbaus implizit bzw. unbewusst entstandenen Formen gemeinsamer Wissensproduktion, die wichtige transdisziplinäre Charakteristiken aufweisen, im Kontext der heutigen Rahmenbedingungen institutionalisiert und somit wiederbelebt werden. Die damit angestrebte Reaktivierung der ursprünglichen Stärken des Biolandbaus in der Wissensproduktion wäre ein wichtiger Schritt in Richtung einer zukünftigen ökologischen und nachhaltigen Landwirtschaft.

Summary

Transdisciplinary knowledge production in organic agriculture

Especially in the initial phase of organic agriculture practical knowledge and the cooperation between farmers, researchers and extension agents played a central role in knowledge production. At this time knowledge exchange shows many characteristics of transdisciplinary knowledge production. Since then the potential of the collaboration of practice and science has more and more been neglected. This tendency is regretted by a majority of key actors of organic agriculture in Switzerland who were interviewed in the framework of this study. The present article illustrates wishes and visions of these actors regarding the future development of knowledge production in organic farming. The analysis reveals that the decreasing intensity of knowledge exchange could be in connection with an increasing influence of traditional institutional structures and a decline of the discussion of the fundamental ideas and philosophical bases of organic agriculture, which relate to a holistic worldview. With regard to a successful further development of organic farming as a sustainable form of agriculture the study recommends to restimulate the formerly intensive knowledge exchange among actors of organic farming by the application of transdisciplinary concepts and research projects.

Résumé

Production de connaissances transdisciplinaire dans l'agriculture biologique

Dans les débuts de l'agriculture biologique principalement, les expériences concrètes et la coopération entre les praticiens, les chercheurs et les consultants ont joué un rôle décisif pour la production de connaissances. L'échange des connaissances pendant cette phase est marqué par de nombreuses caractéristiques de la production de connaissances transdisciplinaire. Depuis, le potentiel de coopération entre la pratique et la recherche est moins reconnu et moins exploité. La majorité des acteurs principaux dans le domaine de l'agriculture biologique en Suisse, interviewés dans le cadre de la présente étude, déplorent cette tendance. Le présent rapport présente les souhaits et les visions de ces acteurs quant au développement futur de la production de connaissances dans l'agriculture biologique. L'étude montre que l'intensité décroissante de l'échange de connaissances pourrait être en liaison avec une influence croissante des structures institutionnelles traditionnelles et une moins forte préoccupation relative aux idées initiales et aux bases philosophiques de l'agriculture biologique qui se rapportent sur une perception holistique du monde. Pour contribuer au développement positif de l'agriculture biologique en tant que forme d'agriculture durable, l'étude recommande de réactiver l'échange de connaissances initialement très intense entre les acteurs de l'agriculture biologique au moyen des concepts et des projets de recherche interdisciplinaires.

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Article V

**Koproduktion von Wissen in der Entwicklung des Biolandbaus -
Einflüsse von Marginalisierung, Anerkennung und Markt**

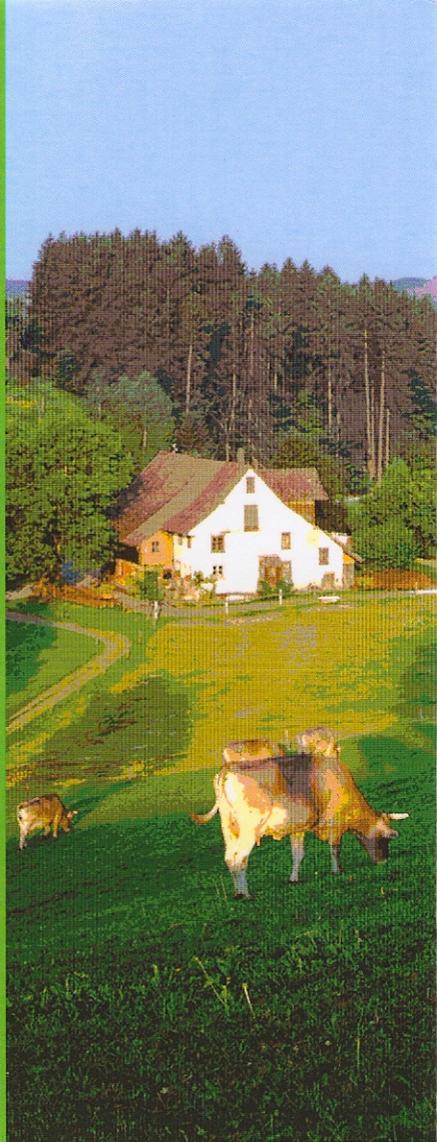
Werte – Wege – Wirkungen:
Biolandbau im Spannungsfeld
zwischen Ernährungssicherung,
Markt und Klimawandel

Beiträge zur 10. Wissenschaftstagung Ökologischer Landbau

Zürich, 11. – 13. Februar 2009

Jochen Mayer, Thomas Alföldi, Florian Leiber,
David Dubois, Padruot Fried, Felix Heckendorn,
Edna Hillmann, Peter Klocke, Andreas Lüscher,
Susanne Riedel, Matthias Stolze, Fredi Strasser,
Marcel van der Heijden und Helga Willer (Hrsg.)

Band 1
Boden, Pflanzenbau, Agrartechnik,
Umwelt- und Naturschutz, Biolandbau
international, Wissensmanagement



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Werte – Wege – Wirkungen Biolandbau im Spannungsfeld zwischen Ernährungssicherung, Markt und Klimawandel

10. Wissenschaftstagung Ökologischer Landbau

Zürich 11.-13. Februar 2009

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Die 10. Wissenschaftstagung Ökologischer Landbau fand vom 11. bis 13. Februar 2009 an der Eidgenössischen Technischen Hochschule in Zürich statt. Ausgerichtet wurde sie von der Forschungsanstalt Agroscope Reckenholz-Tänikon (ART), dem Forschungsinstitut für biologischen Landbau (FiBL), der Eidgenössischen Technischen Hochschule Zürich (ETHZ) sowie der Stiftung Ökologie & Landbau (SÖL). Die Tagung wurde maßgeblich von den Schweizer Bundesämtern für Landwirtschaft und Umwelt und vom Coop Fonds für Nachhaltigkeit sowie von zahlreichen Firmen und Institutionen unterstützt.

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Koproduktion von Wissen in der Entwicklung des Biolandbaus - Einflüsse von Marginalisierung, Anerkennung und Markt

A. Aeberhard¹ und S. Rist.²

Keywords: organic farming, knowledge co-production, transdisciplinarity

Abstract

The empirical analysis of the historical development of transdisciplinary co-production of knowledge (CPK) in organic agriculture (OA) in Switzerland has revealed three distinct phases. The initial phase shows various characteristics of transdisciplinary CPK and a high importance of experiential knowledge. The 2nd and 3rd phases involve an in-creasing segregation of farmers', extension agents', and scientists' knowledge, caused by internal and external impacts, i.e. foundation of

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independent research institutions, changes in agriculture policy, and new market strategies. These developments strikingly represent an ambiguous trend: the growing societal and political recognition of OA and the increasing market, which are positive achievements, are associated by a gradual loss of very precious forms of CPK. A successful re-establishment of CPK processes and re-integration of experiential knowledge would help to resolve this di-lemma and thus improve future research in OA and sustainability research in general.

Einleitung, Zielsetzung und Methoden

Der Biolandbau hat sich im Verlauf der Zeit von einer anfänglichen Außenseiterbewegung zu einer gesellschaftlich und politisch anerkannten ökologischen Bewirtschaftungsform entwickelt. Dieser Prozess zeigt einzigartige Muster von transdisziplinärer (u.a. Max-Neef 2005) Wissensgenerierung auf. Während Wissen üblicherweise in der Wissenschaft erarbeitet und später in die Praxis umgesetzt wird, spielte im Biolandbau praktisches Erfahrungswissen bei der Wissenserzeugung eine essentielle Rolle. Die vorliegende Studie untersucht die Prozesse der Wissens-Koproduktion in der Geschichte des Biolandbaus in der Schweiz mit dem Ziel, deren Charakteristiken und Veränderungen und die Gründe dafür zu erarbeiten. Damit sollen Grundlagen für die Weiterentwicklung des Wissens im Biolandbau und in der Nachhaltigkeitsforschung geschaffen werden. Die Studie basiert auf qualitativen Forschungsmethoden (Flick 2007), einschließlich Dokumentenanalyse und halbstandardisierter Interviews mit Pionier/innen und Schlüsselakteur/innen aus Praxis, Wissenschaft und Beratung im Biolandbau. Die Evaluation der Daten basiert auf thematischer Kodierung.

Ergebnisse und Diskussion

Die vorliegende Studie zeigt auf, dass die Entwicklung der Wissens-Koproduktion im Biolandbau in drei Phasen mit unterschiedlichen Charakteristiken unterteilt ist (Aeberhard und Rist 2008). Die erste Phase umfasst die Anfänge der Biobewegung bis Mitte 70er Jahre. Der Biolandbau entstand als Reaktion auf die zunehmende Industrialisierung der Landwirtschaft und war lange eine Außenseiterbewegung, die sowohl gesellschaftlich wie auch politisch kaum berücksichtigt und von der konventionellen Landwirtschaft sogar abgelehnt wurde (Vogt 2001). Diese Marginalisierung führte zu einem starken internen Zusammenhalt unter den Bio-Pionier/innen (aus Praxis, Beratung und Wissenschaft) und damit zu einer sehr intensiven transdisziplinären Wissensproduktion, z.B. betreffend Erarbeitung geeigneter Bewirtschaftungsmethoden.

Die Gründung von Forschungsinstitutionen bedeutete einen ersten Schritt Richtung Auslagerung der Wissensproduktion in die Forschung, und bildete somit den Anfang der zweiten Phase. Allerdings war die

Wissenschaft zu Beginn stark auf das Erfahrungswissen der Bauern angewiesen, was entsprechenden Austausch erforderte. Aus dem bislang eher erfolglosen Kampf um Anerkennung ergab sich nun der Zusammenschluss der schweizerischen Biolandbauorganisationen (BioSuisse) und die Gründung des gemeinsamen Biolabels „Knospe“, was einen grossen Erfolg darstellte.

Die letzte Phase setzte in den 90er Jahren ein und dauert bis zur Gegenwart. Die breitere Anerkennung des Biolandbaus, die Einführung von Subventionen für ökologische Leistungen und die verstärkte Vermarktung biologischer Produkte führte zu einem starken Aufschwung des Biolandbaus. Bauern stellten jetzt zunehmend aus ökonomischen Gründen auf Biolandbau um. Zudem führte die wachsende Spezialisierung zu erhöhter Bedeutung von (wissenschaftlichem) Spezialwissen. Dies führte zu einem Rückgang des Wissensaustauschs und der Diskussionen über die philosophischen Prinzipien und grundsätzlichen Werte des Biolandbaus.

Diese Entwicklung zeigt ein eindrückliches Dilemma auf: Auf der einen Seite erfolgte nach langem Kampf die gesellschaftliche und politische Anerkennung des Biolandbaus als ökologisch wertvolle und nachhaltige Bewirtschaftungsmethode (z.B. Mäder et al. 2002); der rasch wachsende Markt bot vielfältige Absatzmöglichkeiten, und die Subventionen erhöhten das Einkommen der Bauern. Andererseits gingen durch die zunehmende ökonomische Ausrichtung, die verstärkte Bedeutung von Richtlinien und Spezialisierung die Auseinandersetzung mit den grundsätzlichen Ideen des Biolandbaus verloren. Während die Zusammenarbeit zwischen Forschung und Praxis zu Beginn intensiv war und praktisches Wissen und Erfahrung eine wichtige Rolle spielten, werden heute Forschungsprojekte oft weitgehend ohne Einbezug von praktischem Erfahrungswissen geplant. Auch der interne Wissensaustausch, wie beispielsweise regelmäßiger Gedankenaustausch an Kursen und Tagungen, ist heute viel weniger ausgeprägt.

Die wachsende politische und wirtschaftliche Anerkennung des Biolandbaus hat also paradoxerweise

die gemeinsame Wissenserzeugung und die Zusammenarbeit zwischen Wissenschaft und Praxis beeinträchtigt. Um dieses Dilemma zu überwinden und den erfolgreichen Wissensaustausch wieder herzustellen, müssten die anfänglichen Formen der Wissenserzeugung und das damit verbundene praktische Erfahrungswissen in die zukünftige Nachhaltigkeitsforschung reintegriert werden.

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Aeberhard, Andrea and Rist, PD Dr. Stephan (2009) Koproduktion von Wissen in der Entwicklung des Biolandbaus - Einflüsse von Marginalisierung, Anerkennung und Markt. Poster presented at 10. Wissenschaftstagung Ökologischer Landbau, Zürich, 11.-13. Februar 2009.

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Summary

The empirical analysis of the historical development of transdisciplinary co-production of knowledge (CPK) in organic agriculture (OA) in Switzerland has revealed three distinct phases. The initial phase shows various characteristics of transdisciplinary CPK and a high importance of experiential knowledge. The 2nd and 3rd phases involve an in-creasing segregation of farmers', extension agents', and scientists' knowledge, caused by internal and external impacts, i.e. foundation of independent research institutions, changes in agriculture policy, and new market strategies. These developments strikingly represent an ambiguous trend: the growing societal and political recognition of OA and the increasing market, which are positive achievements, are associated by a gradual loss of very precious forms of CPK. A successful re-establishment of CPK processes and re-integration of experiential knowledge would help to resolve this dilemma and thus improve future research in OA and sustainability research in general.

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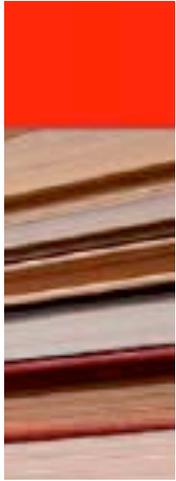
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Conference Paper I

**Koproduktion von Wissen in der Entwicklung des Biolandbaus -
Einflüsse von Marginalisierung, Anerkennung und Markt**



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We confirm that the paper "Knowledge production and dissemination in sustainable agriculture as a transdisciplinary process – experiences from Switzerland" from Andrea Aeberhard, Flurina Schneider and Stephan Rist has been selected by the scientific conference board.

For the conference we did select papers with different empirical and theoretical perspectives that addressed in a short but clear way the topic best.

The organizers of the conference: Euresearch in collaboration with the Swiss Academy for Social Sciences and the Humanities (ASSH) and the College of Management of Technology at the Ecole Polytechnique Fédérale de Lausanne (EPFL).

Denise Erpen
Euresearch Head Office

Knowledge production and dissemination in sustainable agriculture as a transdisciplinary process – experiences from Switzerland

Andrea Aeberhard¹, Flurina Schneider¹ and Stephan Rist¹

¹*CDE – Centre for Development and Environment, University of Berne, Switzerland and National Centre for Competence in Research North-South*

Implementation of innovation is traditionally described by the term “knowledge transfer”. It is mainly seen as a linear, one dimensional process and implies that technologies are supposed to be developed by research and transferred by extension services to users. Based on first insights into two research projects related to present experiences in soil conservation and to the evolution of organic agriculture in Switzerland it can be shown that the “linear model of knowledge transfer” is too limiting to address societal knowledge production for sustainable development.

There is evidence that the described classical conceptions of knowledge production do not reflect the communication and innovation processes which have to be understood as a result of an interplay between everyday life and the structures in which it is embedded. Classical models imply a separation between the places, institutions and actors in the process of knowledge production at the one hand and knowledge use at the other. However, in practice the knowledge system of agriculture is much more complex. Farmer-to-farmer interactions and the knowledge backflow from farmers to researchers, extensionists and policy

makers should not be neglected. Yet knowledge is exchanged and co-produced rather than transferred between these actors acting at different societal levels.

The processes of knowledge exchange and co-production in agriculture are analysed by means of two research projects relating to the development of organic agriculture and to soil conservation in Switzerland. The projects are associated to the National Centre of Competence in Research North-South (NCCR North-South) and the COST action 634. Both projects aim at identifying enabling and inhibiting factors in cooperation and exchange between the knowledge systems of farmers, scientists and extensionists in view of the principles of sustainable development. Therefore, a transdisciplinary approach is an adequate instrument to analyse the different perspectives of and the interplay between the actor groups.

Organic farming represents a unique field with respect to the importance of practitioners in producing knowledge, since most of common practices have been developed by farmers. A second peculiarity of organic farming is its theoretical basis that includes the concept of organisms which as a whole are more than the sum of its parts, and its mutations and behaviour being influenced by its history and development. This is a contrast to the traditional scientific view which implies that any organism or system can be described as the sum of its parts. The theoretical basis of organic farming is mainly non scientific and relies on the one hand on specific conceptions of bio-organic farming and bio-dynamic farming.

Thus there have been many reasons for a difficult relationship between science and organic farming. Nevertheless, organic farmers used scientific knowledge e.g. from microbiology to solve specific problems. However, the only research institute in Switzerland which addresses exclusively organic agriculture has been co-founded by farmers, policymakers and scientists (Research Institute of Organic Agriculture FiBL, www.fibl.org). Organic farming thus represents a complex picture of knowledge production within a diversity of perceptions of natural systems which involve conflicts between traditional science and research by practitioners. Moreover, extensionists in organic farming traditionally perform a two-way knowledge transfer between farmers and research.

In the case of soil conservation there is a considerable gap between research results on soil degradation processes and soil conservation technologies on the one hand, and limited implementation of this knowledge in agricultural practice, on the other hand. The learning and communication processes between scientists, representatives from related public administration and farmers, as well as among farmers themselves, are explored by semi-structured interviews, informal talks and group discussions.

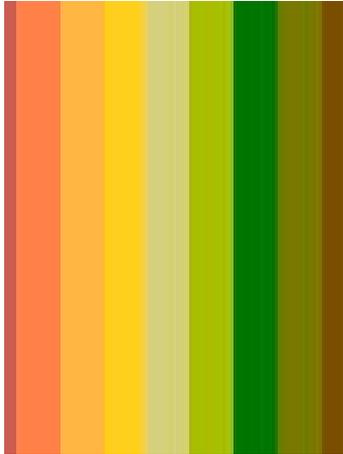
First results show that the development of soil conservation is based on diverse interrelations between farmers, experts of public extension services and scientists. This can be illustrated by a historical examination. The first phase in the seventies

was characterized by increasing awareness of declining soil fertility due to current discourse in society and experiences from foreign countries (e.g. dust bowl in the United States). Subsequently, different actors searched for solutions based on their background. While natural scientists started research on soil erosion processes, farmers introduced and adapted soil conservation techniques such as direct drilling or zone tillage. These activities occurred independently. However, there was close collaboration between farmers and other scientist (e.g. herbologists). Agricultural sciences and extension services started much later to deal with the mentioned technologies. Thus, the development and dissemination of soil conservation techniques in Switzerland can be characterised as mainly farmer driven supported by science and extentionists in later phases.

The research projects show that the development of organic agriculture as well as the field of soil conservation can be understood as joint problem solving among science, technology and society. It is argued that solutions to complex resource management problems can only be developed on the basis of an integration of farmers', experts' and scientific knowledge. This understanding of co-knowledge production is strongly related to the concept of transdisciplinarity.



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Conference Paper II

**Collaborative research in the development of
organic agriculture in Switzerland – a case study**

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Creating Values for Sustainable Development

Proceedings of the 2nd International Sustainability Conference

21-22 August 2008
Basel, Switzerland

Editors:
Claus-Heinrich Daub
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Yvonne Scherrer

10-1 Collaborative Research for Sustainable Development

Collaborative research in the development of organic agriculture in Switzerland – a case study

Andrea Aeberhard¹ and Stephan Rist²

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Keywords: transdisciplinarity, knowledge co-production, collaborative research, organic agriculture

There is a growing consensus that sustainable development does not represent a result of traditional linear sequence, in which action taken outside of the scientific community aims at solutions which are proposed by the scientific community (Roux et al. 2006). Collaborative approaches to knowledge co-production involving members of the scientific and non-scientific communities are therefore a basic feature of sustainability science (Clark and Dickson 2003). In this sense, 'mode 2' (Gibbons et al. 1994) and other forms of transdisciplinary knowledge production (Wiesmann et al. 2008) are basic features of sustainability science.

The broader the difference between the cultural, social and epistemological background of the scientists and other actors who are trying to find more sustainable development paths, the more important is collaborative research. The present case illustrates one aspect of a systematisation of experiences regarding potentials and limitations of collaborative research resulting from several case studies carried out in the National Centre of Competence in Research (NCCR) North-South. It shows that major obstacles in collaborative research are the reluctance of the scientists to acknowledge the added value of 'local' forms of knowledge of practitioners, and that practitioners do not tend to automatically accredit the practical relevance of the scientific results.

Currently, methods of collaborative research are mainly conceptualized on the academic level and thus, are mainly based on theoretical concepts. However, there are examples of collaborative research, which emerge 'unconsciously' and independently of theoretical reflections or external stimulation. Analyzing such examples, as in our case organic farming, allows identifying basic characteristics of processes of knowledge co-production at the interface of science and society, and by this, determining enabling and hindering factors of collaborative research.

Moreover, taking into account that the development of organic agriculture is representing historical dimensions, it helps to assess potentials and limitations of collaborative research also with regard to the long-term perspective. In this sense we believe that empirical findings can help to improve concepts, methodologies and practices of collaborative transdisciplinary research.

A successful example of transdisciplinary or collaborative research can be observed in the development of organic agriculture in Switzerland. The identification and analysis of the different thought styles and thought collectives (Fleck 2002) of the actors, as in the present case farmers, scientists and extensionists, forms a solid basis for the examination of co-production of knowledge observed in the

past and present development of organic farming in Switzerland. This basis allows the identification and comparison of different forms of knowledge of farmers, scientists and extensionists including the consideration of their specific social, historical, philosophical and epistemological background. Based on empirical data, the study shows that there is a distinct evolution in the history of organic farming, which can be divided in three phases. We have shown that in the initial phase of organic agriculture (ca. 1920 – 1974), knowledge production was strongly based on collaborative or transdisciplinary research (Aeberhard and Rist 2008). Moreover, we have observed a gradual segregation of the thought collectives of practice, extension and research, which provoked a decrease of collaborative research over time, and thus a loss of the corresponding innovation potential. Thus, research has increasingly been based on natural science and economics, and the philosophical visions present in the former phases of the organic movement were marginalised.

The present study can give important advice and stimulus for other areas and for the development of basic concepts. The analysis also shows that this development is not only caused by external influences to the movement of organic agriculture: If the organic movement had not only focused on the results of the transdisciplinary co-production of knowledge, but also had attempted to institutionalize the forms of knowledge production through which organic agriculture has been developed, the problem may have been overcome to a certain extent.

This suggests that initiatives that aim at the promotion of collaborative co-production of knowledge should at the same time ensure the institutionalization of its results as well as its forms of transdisciplinary knowledge production. In this sense, it is crucial to reflect and analyse the process of collaborative co-production of knowledge in the history of organic farming because it helps to find new forms of cooperation, experience exchange and knowledge transfer between the scientific and the practical (and possibly the political) world.

Based on the main findings of the present study additional aspects of collaborative research for sustainable development will be presented considering other cases analysed within the framework of NCCR North-South.

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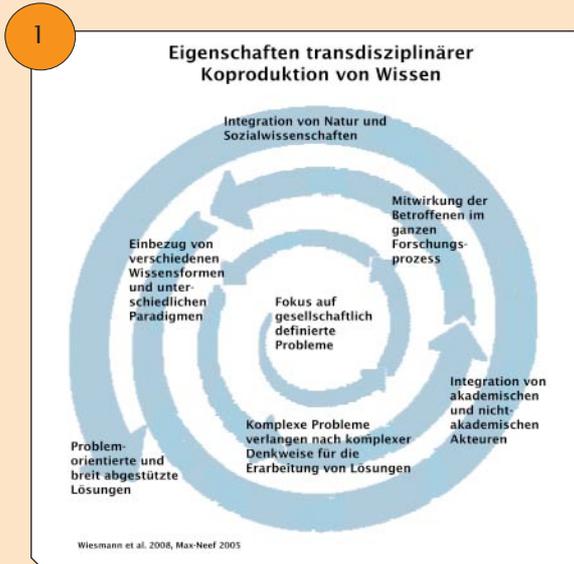


Conference Poster

Transdisziplinäre Koproduktion von Wissen im Biolandbau in der Schweiz

Transdisziplinäre Koproduktion von Wissen im Biolandbau in der Schweiz

Andrea Aeberhard, PD Dr. Stephan Rist, Centre for Development and Environment, NCCR North-South, Universität Bern



Erkenntnisse:

- Insbesondere in der Anfangsphase zeigt der Biolandbau klare Strukturen von kollektiver Koproduktion von Wissen auf
- Abnahme der Transdisziplinarität im Verlauf der Entwicklung des Biolandbaus
- Zunahme der externen Einflüsse (z.B. Markt, Politik)
- Akteure wünschen eine Reaktivierung der gemeinsamen Wissens-Koproduktion und einen verstärkten Einbezug in die Biolandbauforschung

Schlussfolgerungen:

Für die Weiterentwicklung des Biolandbaus und die Verbesserung der Wissens-Koproduktion ist es wichtig, dass:

- die Akteure den Pioniergeist zurück gewinnen und sich wieder mehr mit den Grundlagen des Biolandbaus auseinandersetzen.
- transdisziplinäre Wissensproduktion institutionalisiert und praktisches Erfahrungswissen in die Forschung integriert wird.
- die Biolandbau-Gemeinschaft wieder Macht und Selbstbestimmung zurück erhält.

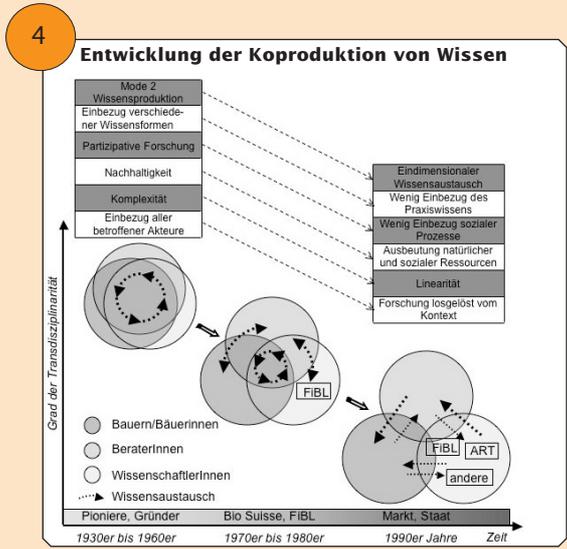
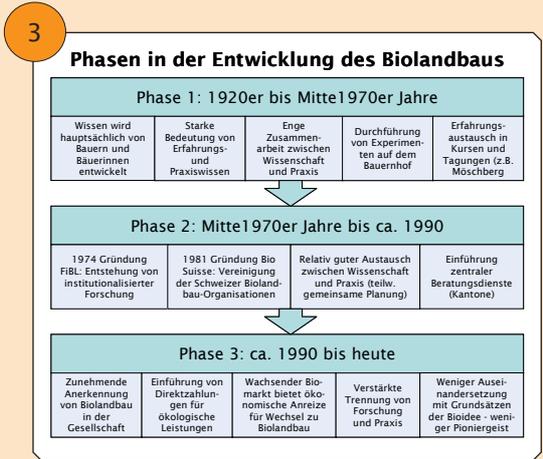
Ausgangslage:



- Biolandbau erhält zunehmend gesellschaftliche, ökologische und ökonomische Wichtigkeit als nachhaltige Form der Landwirtschaft.
- Biolandbau weist höchst interessante Formen von Wissens-Koproduktion auf, insbesondere am Anfang wurde Wissen vorwiegend in der Praxis generiert.

Ziel:

- Analyse der Entwicklung von transdisziplinärer Koproduktion von Wissen in der Geschichte des Biolandbaus in der Schweiz
- Untersuchung der Wirkung von hemmenden und fördernden Einflussfaktoren auf die Wissens-Koproduktion im Biolandbau



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Erklärung

gemäss Art. 28 Abs. 2 RSL 05

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Bachelor Master Dissertation

Titel der Arbeit: Transdisciplinary co-production of knowledge in the development of organic agriculture in Switzerland

Leiter der Arbeit: PD Dr. Stephan Rist
Prof. Dr. Urs Wiesmann

Ich erkläre hiermit, dass ich diese Arbeit selbständig verfasst und keine anderen als die angegebenen Quellen benutzt habe. Alle Stellen, die wörtlich oder sinngemäss aus Quellen entnommen wurden, habe ich als solche gekennzeichnet. Mir ist bekannt, dass andernfalls der Senat gemäss Artikel 36 Absatz 1 Buchstabe o des Gesetzes vom 5. September 1996 über die Universität zum Entzug des auf Grund dieser Arbeit verliehenen Titels berechtigt ist.

Bern, 12. August 2009

Curriculum Vitae

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- 1997 – 2005 Studies of Sociolinguistics (lic.phil.hist), University of Bern
- 2000 – 2001 Erasmus semester abroad, University of Cardiff, GB
- 1998 – 1999 Two-semester course of computer science, Department of Teacher Education, University of Bern
- 1996 – 1997 Studies abroad, Olney Central College, Illinois, USA
- 1992 – 1996 Matura Typus C (university entrance degree), Gymnasium Bern Neufeld

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- 2003 – 2005 Scientific assistant at National Research Programme 48 “Landscape and Habitats of the Alps”, KILA research group, Interfaculty Coordination Office for General Ecology (IKAÖ), University of Bern
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