# Social Learning in Innovation Networks:
## How multisectoral collaborations shape discourses of sustainable agriculture

Frans Hermans

**Thesis committee**

**Thesis supervisors**

Prof. dr. ir. A. Veldkamp
Professor of Land Dynamics
Wageningen University

Prof. dr. ir. J.T. Mommaas
Professor of Leisure Studies
Tilburg University

**Thesis co-supervisor**

Dr. K. Kok
Assistant professor, Land Dynamics Group
Wageningen University

**Other members**

| | |
|---|---|
| Prof. dr. B.J.M. Arts | Wageningen University |
| Prof. dr. ir. C. Leeuwis | Wageningen University |
| Dr. D.A. Loorbach | Erasmus University Rotterdam |
| Prof. dr. L.A.G. Oerlemans | Tilburg University |

This research was conducted under the auspice of the C.T. de Wit Graduate School for Production Ecology and Resource Conservation (PE&RC).

# Social Learning in Innovation Networks:
## How multisectoral collaborations shape discourses of sustainable agriculture

Frans Leon Paul Hermans

**Thesis**
submitted in fulfilment of the requirements for the degree of doctor
at Wageningen University
by the authority of the Rector Magnificus
Prof. dr. M.J. Kropff,
in the presence of the
Thesis Committee appointed by the Academic Board
to be defended in public
on Monday 12 December 2011
at 1:30 p.m. in the Aula

Frans Hermans
Social Learning in Innovation Networks: How multisectoral collaborations shape discourses of sustainable agriculture
184 pages

Thesis Wageningen University, The Netherlands (2011)
With references, with summaries in Dutch and English

ISBN 978-94-6173-098-5

# Table of Contents


**1 Introduction 9**

1.1 Complex persistent problems 10
1.2 Transition theory 12
1.3 The multi-level perspective of transitions 14
1.4 Problem definition 16
1.5 Research questions 19
1.6 Research context 19
1.7 Structure of this thesis 20

**2 Evaluation of Stakeholder Participation in Monitoring Regional Sustainable Development 23**

2.1 Introduction 24
2.2 Stakeholder participation in monitoring sustainable development 25
2.3 Evaluation of participatory monitoring processes 26
2.4 Case descriptions 31
2.5 Cross-case analysis 35
2.6 Discussion and conclusions 41

**3 The Contested Redefinition of a Sustainable Countryside: Revisiting Frouws' Rurality Discourses 43**

3.1 Introduction 44
3.2 Discourses, discourse coalitions and regimes 45
3.3 Discourses on sustainable rural development 46
3.4 Method 50
3.5 Results 52
3.6 Discussion 57
3.7 Conclusion 59

**4 Assessing Sustainability Perspectives in Rural Innovation Projects using Q-Methodology 61**

4.1 Introduction 62
4.2 Discourse analysis of sustainable development and sustainable agriculture 62
4.3 Method: Q-methodology 64
4.4 Results 75
4.5 Discussion 78
4.6 Conclusions 80

**5 The Distribution of Roles and Functions for Networking in Agricultural Innovation Systems; a Social Network Analysis 83**
5.1 Introduction 84
5.2 The multi-level perspective and emerging technologies in technological innovation systems 85
5.3 Network functions within innovation systems 86
5.4 Materials and methods 90
5.5 Results 98
5.6 Discussion 105
5.7 Conclusions 106

**6 Niches and Networks: Explaining Network Evolution through Niche Formation Processes 109**
6.1 Introduction 110
6.2 Niches and networks 111
6.3 Method 114
6.4 Results 121
6.5 Discussion and conclusions 127

**7 Synthesis: Collaborative Innovation Networks for Sustainable Agriculture 131**
7.1 Introduction 132
7.2 Main findings of the research questions 133
7.3 Implications of main findings 139
7.4 Recommendations for further research 144
7.5 Recommendations for policy makers 146

**References 149**

**Summary 169**

**Samenvatting 171**

**Acknowledgements 175**

**About the author 179**
Curriculum Vitae 179
Peer reviewed publications 180
PE&RC PhD Education Certificate 181

# Chapter 1

## Introduction

## 1.1 Complex persistent problems

This thesis addresses the fundamental question of how innovations can contribute to sustainable development and sustainable agriculture in particular. Reading the newspaper on any given day shows that the combination of sustainable development and innovations is by no means undisputed. Sometimes it seems that for every new technological innovation that is introduced, an unexpected problem suddenly pops up. In fact more often than not it seems that technological development itself is to blame for many of today's most central and pressing problems. The German sociologist Ulrich Beck described how modern society is continuously running in the same circle, 'stumbling over its own feet', trying to solve its self-created problems of the past. He has argued that many of these problems are in fact the by-product of earlier phases in the modernisation process of western society. He introduced the term 'risk society' to denote a new phase in modernity, a phase increasingly occupied with debating, preventing and managing the risks that it has produced itself (Beck, 1999).

The agricultural sector is the case in point. For decades agricultural systems were thoroughly analysed to find the best technology to increase the performance of one specific system component (usually outputs or yields). The study of increasingly complicated processes also led to the increasing specialisation of the experts involved. Agricultural research and development became organised with specialised agricultural universities developing new knowledge that was subsequently spread to farmers by government sponsored extension workers (Leeuwis and Van den Ban, 2004). The linear model of technology development has worked miracles in the past, doubling or sometimes even tripling agricultural productivity per hectare in industrialised countries between the years 1961 and 2000 (IAASTD, 2009). Since World War II, food production has increased at a faster pace than human population, proving the pessimistic predictions of Thomas Malthus (1798) to be wrong. However, this green revolution came at a price. It was accompanied by a number of negative side effects that slowly have become unacceptable to more and more people. Whether it is the outbreaks of contagious animal diseases (and the subsequent killing of perfectly healthy animals to prevent further spreading), fertilizers leeching phosphates and nitrates into ground water and surface waters, and safety and health considerations related to the use pesticides in the human food chain, they are all examples of the type of persistent societal problems that represent the downside of some of the dominant existing societal and technological structures that are present in the agricultural sector.

Solving these problems has so far proven to be difficult and some of the proposed solutions, the use of genetically modified organisms (GMOs) in agriculture for instance, are accused of only exacerbating the problems. It raises the question what

makes these problems so particularly able to defy traditional problem solving strategies? In the scientific literature this type of persistent problem has become known under different names as ill-defined, intractable, complex, messy or wicked problems (Ackoff, 1974; Hisschemoller and Hoppe, 2001; Ritter and Webber, 1973; Van Bueren et al., 2003; Vennix, 1999).

Roelofs (2000) distinguishes three interrelated dimensions that contribute to the complexity of a problem:

a. Cognitive complexity concerns questions of knowledge about an issue: what are its components and how are they related. Dynamic systems that display non-linear behaviour are notoriously difficult to predict and understand. More information is not always the answer to deal with the inherent systemic uncertainties that complex adaptive systems exhibit.
b. Normative complexity concerns the conflicting norms and values of actors. Individual world views, norms and values condition the perceptions, expectations and (inter) actions of humans. The bigger the differences between the value systems of different actors, the more complex an issue will become.
c. Socio-political complexity concerns conflicting interests. If there are many actors, chances increase that there are also many different interests and that it becomes more difficult to align these interests. Even between actors sharing the same world view, conflicts of interest and political struggles are possible, especially when proposed solutions will likely result in winners and losers.

In the remainder of this thesis, the term complex problem will be used to designate the kind of societal problems that form the by-product of the earlier modernisation process. One explanation why these complex problems are so difficult to resolve lies in the fact that they are the product of societal structures and therefore also strongly embedded within them. The concept of sustainable development has come up as a possible ‘reflexive’ governance approach to some of these persistent complex problems (Beck et al., 1996; Voss et al., 2006). This does not only call for new technologies, but also requires a reordering of societal structures and social change. Such profound changes, that go beyond simple technological fixes, are called system innovations or transitions. The study of these large systemic innovations has been taken up in a relatively new field, that of transition studies or transition theory.

## 1.2 Transition theory

Transition theory studies long-term processes of profound transformation that "*involve mutually coherent changes in practices and structures, and because of their multilayeredness and inevitable entrenchment in society and culture at large they are very complex and comprehensive phenomena"* (Grin et al., 2010; p. 3). Or formulated slightly differently transitions can be defined as fundamental changes in society's structure, culture and practices (Loorbach and Rotmans, 2006). Transition theory takes up the challenge of reflexive governance in a number of ways:

1. *It stresses the need to break away from the linear top-down perspective of innovation:*

   Since typical complex problems cannot be solved by providing more and more information from experts alone, new ways of knowledge development are promoted that also involve societal 'stakeholders': those actors that are either affected by, or possess the ability to influence its development. By taking stakeholder views into account the socio-political and normative aspects of complex problems can be addressed at the same time. These type of multi-actor processes are often referred to as processes of knowledge co-creation, or 'mode 2' science (Funtowicz and Ravetz, 1993; Gibbons, 1999; Nowotny et al., 2003; Regeer, 2009). They stress the importance of multidisciplinary or interdisciplinary research projects involving a wide array of scientists, businesses, government agencies and NGOs in the process of creating new knowledge and innovations.

2. *It takes a broad view of innovation:*

   The successful introduction of new technologies also requires societal changes. An innovation is not regarded as a 'simple' technological device that is either adopted or rejected by an individual. Instead, innovations are seen as being integrated within of chain of partial innovations together with new social and organisational arrangements: the new rules, perceptions, procedures, agreements and social relationships, that are developed alongside it (Hekkert et al., 2007). With this the focus shifts towards an analysis of the whole innovation system and the network of actors and their interactions that make up such a system (Klein Woolthuis et al., 2005; Markard and Truffer, 2008b).

3. *It places special emphasis on learning and experimentation:*

   Learning and experimentation has become a central element in reflexive governance approaches (Cundill et al., 2005; Voss and Bornemann, 2011). The concept of learning used in transition studies starts from the assumption that learning occurs and knowledge can be created through conversations and interactions between stakeholders. Learning is therefore seen as a social

process. New ideas are not necessarily the work of one brilliant individual. Instead, many new ideas come from applying existing ideas in a new social context, or by the recombination of existing ideas (Burt, 2005). Creativity and innovation are therefore stimulated by cooperation and active exchange of ideas. By bringing people together and giving them an opportunity to share their ideas and discuss them with other people, they align their personal mental models into a shared group model and as they learn from each other and form new relationships they develop the capacity to take collective action and manage their environment (Armitage et al., 2008; Stringer et al., 2006). Shared visions thus become an important driver for the process of transitions (Beers et al., 2010).

Two different, but in many aspects complementary, strains of research have come to the fore that use this analysis of complex societal problems as point of departure. *Transition Management* and *Strategic Niche Management* do not only study these long term societal changes, but also want to actively contribute to these societal transformations towards sustainable development.

Strategic Niche Management (SNM) has the more technical outlook of the two and it takes its inspiration from historical case studies using an evolutionary perspective (Kemp et al., 2001; Rip and Kemp, 1998; Schot and Geels, 2008; Schot et al., 1994). Drawing on these historical case studies, practitioners have started to experiment with novelties in a protected niche in order to actively work on transitions to sustainability, for example the electric car (Schot et al., 1994) and the use of biomass for the generation of bioenergy (Raven, 2005). Transition Management has broadened the view of transitions to more general societal change. It starts its analysis from a perspective of Complex Adaptive Systems, focussing on forms of action research and social learning, where the investigators actively interact with their research subjects (Loorbach and Rotmans, 2006; Rotmans et al., 2001b). Examples of some typical studies include shifts in institutional regimes and management styles like water management (Loorbach and Rotmans, 2006; Van der Brugge et al., 2005), sustainable mobility (Kemp and Rotmans, 2004) and waste management (Rotmans and Loorbach, 2010).

Even though there are therefore some differences between these two approaches in terms of their conceptual focus and units of analysis, they also have their particular overlaps of which the use of the multi-level perspective is probably the most important one.

## 1.3 The multi-level perspective of transitions

The multi-level perspective brings the elements of learning, bottom-up innovations and processes of social change in a single research framework for transitions. The multi-level perspective, or MLP for short, has been developed especially within the context of Strategic Niche Management and has a strong evolutionary perspective of technological change. The MLP is used to explain how local knowledge and innovations in a specific (experimental or pilot) context spread from the micro-levels of small groups of innovators to higher macro levels in society. The MLP makes a distinction between three more or less hierarchical levels of niches, regimes and socio technical landscapes that form the micro-, meso and macro level of bottom up socio-technological development processes, see Figure 1.1 (Geels, 2002; Geels and Schot, 2007).

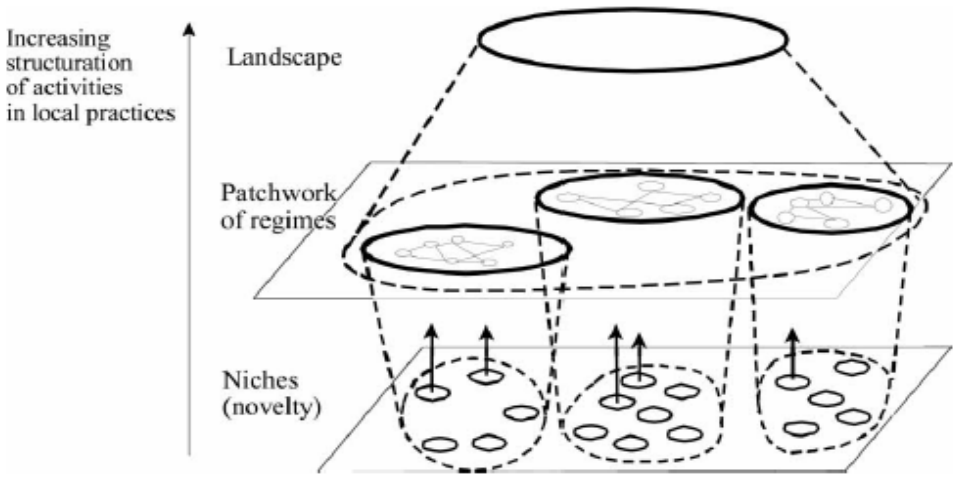



**Figure 1.1.** The three different levels of transitions (source: Geels, 2002)

1. *The niche level:*

   Technological niches form the micro level where radical novelties emerge. These novelties are initially unstable socio-technical configurations with low performance. The actors in these niches are prepared to accept this low performance and higher costs and are willing to work to improve the new technology. Niche innovations are therefore often carried and developed by small networks of dedicated fringe actors, defined by Van de Poel as 'outsiders': they are outside or at least marginal to the regime, and they do not share some of the relevant rules with respect to technical development (Van de

Poel, 2000). Learning and experimentation is done within these niches and they rely on the contribution of multidisciplinary groups of stakeholders to be involved. Successful experiments can be used to interest new actors and make the niche grow and develop over time (Geels and Raven, 2006).

2. *The socio-technical regime:*

   The socio-technical regime is an extended version of the technological regime of Nelson and Winter (1977). Rip and Kemp (1998) define a socio-technical regime as "*the grammar, or rule-set comprised in the coherent complex of scientific knowledge, engineering practices, production process technologies, product characteristics, skills and procedures, ways of handling relevant artefacts and persons, ways of defining problems, all of them embedded in institutions and infrastructures"*. As such a regime has a cognitive part, namely the collective knowledge shared among members of the regime: their rules, and knowledge (Deuten, 2003; Stuiver et al., 2003). Additionally a socio-technical regime has a physical and material part as well: the artefacts, production processes, technologies and infrastructures that are the embodiment of existing practices. The concept of the socio-technological regime offers an explanation why change is often so difficult to achieve. Actors involved in technological processes have difficulty in thinking 'outside the box' as they are conditioned by the existing ways of doing things. Secondly the existing technical infrastructure favours certain directions of new investments, giving radically new technologies a hard time to fit in.

3. *The socio-technical landscape:*

   The highest level of the MLP is formed by the socio-technical landscape. It can be viewed as an exogenous environment that is not under the direct influence of the actors in the regime and niches. It includes macro-economic trends, deep cultural patterns, and demographic developments that only change at a very slow pace (hence the use of the term 'landscape'). For instance the ageing of a population has a deep impact on society, but occurs at a very slow pace and is difficult to influence directly.

The different levels of the MLP are defined by their degree of structuration. The higher the level the more aggregated the components and relationships between actors and the slower the dynamics between them. New practices at the niche level can still easily change, however at the level of the socio-technical regime this flexibility is already greatly diminished and at the landscape level changes may take years or even decades.

The multi-level perspective has become a very popular framework to study transformative innovations within society. However, it is not completely undisputed. For example, the analytical distinctions between the different levels of

the MLP sometimes seem to be somewhat arbitrary. The differences in structuration of different levels are of a gradual nature in which one level blends into the next. The core concepts of niches, regimes and landscape therefore differ from study to study, leading to a wide range of definitions being in use (Markard and Truffer, 2008b; Raven et al., 2010). Studies have shown that the boundaries between niches and regimes sometimes become blurred or even disappear altogether (Elzen et al., 2008; Smith, 2006; Smith, 2007). This has led some authors to call for a less hierarchical view of the MLP (Elzen et al., 2008; Loorbach, 2007).

A second criticism is levelled at the historical case studies making use of the MLP. These studies are accused of having a teleological bias towards the 'winning' technology (Genus and Coles, 2008). The MLP often explains the breakthrough of a particular technology by one or more shocks or pressures at the landscape level that lead the existing regime to open up and offer a chance to the niche level to take over. The MLP thus struggles with the issue of agency as the contribution of individual decisions and actions in the storyline is hidden. In the literature there is a call for more attention to the specific role individuals play at the micro level of niches (Alkemade et al., 2011; Markard and Truffer, 2008a).

In this thesis the multi-level perspective will be used as an heuristic device that helps to reflect on some of the important relationships between the central elements that this thesis deals with. It offers a comprehensive way of understanding the origin and development of transformative innovations within society and a starting point to discuss these matters.

## 1.4 Problem definition

Both the TM and the SNM approach stress the importance of learning and experimentation in multidisciplinary collaborations involving a wide range of stakeholders. However, the idea of social learning as a means to foster creativity and consensus in niches underplays issues of competition, negotiation and conflicts between stakeholders with competing interests (Leeuwis, 2000; Leeuwis and Van den Ban, 2004; Meadowcroft, 2005). Consensus is not always desirable because too much consensus within a group of stakeholders might lead to a tunnel vision, excluding all other contradictory or inconvenient information. On the other hand, too many competing and contradictory mental models can stifle cooperation or action, particularly when the potential actions suggested by each are very different. Conflict can both spur learning (when actors develop knowledge to strengthen their arguments) or conflict can inhibit learning when stakeholders are no longer listening to each other and a 'dialogue of the deaf' develops (Eshuis and Stuiver, 2005; Van

Eeten, 1999). Participation processes that depend on stakeholder input and processes of social learning quickly lead to a unique solution that is difficult to scale up or apply in other contexts (Van de Kerkhof and Wieczorek 2005). The generated outputs of participatory exercises are only applicable for that specific moment in time, for that specific problem and for the stakeholder groups that were directly involved. This means that the quality of the outputs of participation projects can be debated due to lack of an objective yardstick (Coglianese, 1999, 2002). The tensions between the possibilities of social learning to contribute to sustainable innovations but also its problems to scale them up, between content and process therefore, provides the central dilemma of this thesis.

The first element of this thesis deals with the content of the concept of sustainable development and more specifically sustainable agriculture. Even though SNM and TM explicitly aim to advance sustainable development, the question what this entails is rarely given much thought in most publications. Transition Management emphasises the importance of initiating a whole range of innovation projects, each with different visions of sustainability. This 'basket of images' as Loorbach and Rotmans (2006) have called it, can contain complementing, but also contradiction and competing visions. It is acknowledged that guiding visions have an important role to play in transitions, but so far not much works has been done investigating what the competing or complementing elements of these visions look like and what is 'inside the basket' when it comes to issues of sustainable agriculture. Furthermore, some authors question whether it is possible to ensure that a particular set of actors engaged in a niche reflect an appropriate range of social interests and perspectives. They argue that it is perhaps more likely that profoundly different visions continue to be promoted by different established interests from the existing socio-technical regime (Berkhout et al., 2004). Others echo the general problems with stakeholder participation when they call vision exercises "rituals, where actors express good intentions as a form of public impression management." (Schot and Geels, 2008; p. 542). The first aim of this thesis therefore is to investigate in how far niche visions on sustainable agriculture diverge from the existing societal debates on agriculture.

The second part of this thesis deals with the question how a successful innovation developed at the niche level may spread (or not) and how a niche develops over time. Given the intrinsically relational nature of social learning in a complex environment, it can also be framed as a network: places where a broad range of participants generate new knowledge and subsequently distribute this over the participating partners and further beyond (Van Bueren et al., 2003). Network studies have been extensively used to model the top-down linear model of technology transfer, however network studies that focus on the development and spread of bottom-up innovations are still relatively rare (Spielman et al., 2008).

What is needed is to investigate the different roles and functions that actors have to perform as they collaborate together in an innovation network that not only aims to change (agricultural) practices, but also aims to change the institutional context that these practices take place in (Moore and Westley, 2011).

The network of a niche is identified to be an important element that helps to connect different actors and organisation with each other, disseminate information and reach potential new partners to collaborate with (Raven, 2005). It is increasingly acknowledged that the structure of a network plays an important role in explaining the potential of emerging technologies to become successful innovations and transitions (Caniëls and Romijn, 2008; Spielman et al., 2010; Van der Valk et al., 2011). However, so far its role has remained only qualitatively described in transition studies. What is needed is to systematically study the characteristics of a niche's network over time as it slowly evolves under influence of the actions of the actors in the niche.

Social Network Analysis offers a tool to describe different networks systematically. Currently however, social network analysis is dominated by network studies that explain the performance of either an individual, a company or sometimes the whole network in terms of the network's structure. People or companies are located at different structural positions in the network, giving them different access to new knowledge or resources (Borgatti and Foster, 2003). Networks themselves are either cohesive with many overlapping ties between the nodes or sparse with only few ties between the nodes and each of these structural characteristics influence the possibilities of the nodes for communication, development and exchange of new ideas (Meeus et al., 2008). However, this is only part of the whole picture. Paraphrasing Giddens (1984), one could speak of 'the duality of network structure': social networks are both the result of social interactions and reproduce these social interactions at the same time. This shifts the focus of the analysis from the influence network structure exerts on the individual to a more process-oriented view on networks (Oerlemans et al., 2007).

The issue how (changing) network structures are the result of individual behaviour has been raised mostly in the domain of physics, where the generation of large 'scale-less' networks (where the distribution of ties in the network follows a power law) are the result of processes of preferential attachment at the micro level (Barabási and Albert, 1999; Newman, 2003). Social scientists have called this preferential attachment mechanism 'rather simplistic' (Powell et al., 2005), but so far there has not been much work done on crossing the divide between the social and natural sciences use of network analysis (Borgatti et al., 2009). The second aim of this thesis is therefore to develop a new perspective on niche development by broadening the application of social network analysis beyond the structural accounts that currently dominate the literature.

## 1.5 Research questions

The following five research questions will be addressed in this thesis:

1. How can the participation of stakeholders be evaluated and how do issues such as context, time and different designs of the participation process influence its results?
2. What are the current Dutch perspectives on sustainable agriculture?
    - How are they related to existing perspectives on sustainable development and rurality?
3. What different vision of sustainable agriculture can be discerned in different innovation projects aiming for a transition?
    - What does this mean for the innovation potential of the Dutch agricultural sector?
4. What role and functions do different actors and organisations have in the upscaling and outscaling of niche innovations?
    - How are different network functions distributed within an agricultural niche?
5. How does the network of a niche evolve over time?
    - How can changes in network structure be explained by the niche's internal processes?

## 1.6 Research context

This thesis is the result of a collaboration between Telos, the Brabant Centre for Sustainable Development, and the Land Dynamics group of Wageningen University. During the four years of my PhD research, I worked two days a week at Telos in Tilburg and three days a week in Wageningen as a PhD student. These two organisations were connected through the TransForum innovation programme that has also funded part of this research. TransForum therefore formed an important context for the research described in this thesis and I will introduce this innovation programme below.

TransForum was a Dutch innovation programme that ran between 2004 and the end of 2010. During that time, TransForum set up over 30 innovation projects covering a wide range of topics in which participants could try out new ideas, learn from them and work together to overcome obstacles hindering system innovation. TransForum's aim was to contribute to a more sustainable Dutch agricultural sector by 'triggering transitions' (Veldkamp et al., 2009). TransForum viewed sustainable

development not as an end state, but as a process that is not linked to any particular technological practice or vision. The overall innovation strategy of TransForum promoted a bottom-up vision of innovation: all projects could be characterised as 'learning-by-doing' and 'doing-by-learning'. Practical problems and ideas of entrepreneurs were the drivers of the innovation process.

Practice and research closely collaborated in the innovative projects and scientific knowledge was used in a number of ways. First of all, scientific knowledge was used directly in practical projects to contribute to addressing specific knowledge gaps, formulating and answering specific research questions in the context of an innovative project. Secondly, the process of innovation itself was made an object of research. The portfolio of TransForum consisted of a number of projects that were divided into three packages: 'vital clusters', 'regional development' and 'international agro-food networks'. Several scientific programmes ran in parallel to the practical innovation projects and used their practical experiences with scientific insights on sustainable development, inventions, innovation and transitions. This thesis received funding from TransForum under the scientific programme 'images of sustainable agriculture'. As it was, the whole programme was inspired by transition theory and its focus on multidisciplinarity, learning processes involving multiple stakeholders and complex adaptive system thinking (Van Latesteijn and Andeweg, 2011; Veldkamp et al., 2009).

The TransForum programme features in this thesis in a number of ways. First of all I will be looking at the whole programme. The TransForum programme as such provides a good context to investigate the basket of images on sustainable agriculture. The aim of the programme was to 'trigger tansitions' and the practical innovation projects were selected for funding on the basis of the range of stakeholders involved, and on the triple bottom-line considerations of sustainability: people, planet and profit (Elkington, 1998). Secondly I will be using one of these innovation projects as one of the cases that I will use to map the changes in an innovation network over time. This case, the Northern Frisian Woodlands, was already extensively described in term of niches, regimes and transitions (Wiskerke and Van Der Ploeg, 2004) and therefore provides an excellent case to re-examine using a network perspective.

## 1.7 Structure of this thesis

The thesis consists of seven chapters in total. In the next five chapters one of the research questions be investigated. Chapter 2 does not relate directly to the agricultural sector as the rest of this thesis does, but this chapter forms a good introduction of many of the themes that I will explore in the subsequent chapters. It

contains the story that made me interested in stakeholder participation and social learning for sustainable development in the first place. This chapter details some of the experiences of me and my colleagues at Telos, in the participatory development of a regional monitor for sustainable development. It deals with questions on how to operationalise the concept of sustainable development, stakeholder participation and social learning, the development of a shared vision in the form of a regional agenda and subsequently our experiences attempting to apply our method in different contexts and at different scales.

The discussion on the monitoring of sustainable development is therefore also a good starting point for the discussions in the next two chapters on the meaning of the concept of sustainable development within agriculture. Chapter 3 will look specifically at how discourses of rurality and sustainable development are related in the Netherlands. In the next chapter, chapter 4, the 'basket of images' present in the project portfolio of the TransForum programme will be investigated and the results will be linked to their potential to foster innovations and transitions in the agricultural sector.

Chapter 5 introduces the network perspective to study the relations between niches, agricultural system and innovation networks. It focuses attention on the 'distributed agency' (Grin et al., 2011) within innovation networks that are necessary for the up- and outscaling of a local innovation. It identifies three important network functions in innovation systems and investigates how these functions are distributed over the actors making up the network.

In chapter 6, the process of network evolution takes centre stage. The network structure of the Northern Frisian Woodlands and how it evolved over time will be described. This chapter will show how the size, composition, cohesion and centrality of a niche's network changes as new multidisciplinary collaboration projects start and old projects end. Finally, in chapter 7 the main findings of this thesis will be synthesised and presented, together with the conclusions and recommendations.

# Chapter 2

# Evaluation of Stakeholder Participation in Monitoring Regional Sustainable Development

*This chapter presents a theoretical framework that can be used to discuss the question of how context, time and different participatory process designs influence the results of participatory monitoring projects in terms of concrete outputs (such as sustainability indicators) and the more intangible social outcomes (such as learning and stakeholder relations). We will discuss and compare four different cases of participatory monitoring of provincial sustainable development in the Netherlands. The results show sustainability issues selected by the stakeholders reflect the socio-economic and ecological structural characteristics of their region. In a different context, stakeholders not only assign different weights to the same set of issues, but more importantly they select a completely different set of regional aims altogether. Since these regional structural characteristics only change slowly over time, the influence of time on stakeholder preferences is shown to be only of minor importance. However, the dissipation of learning effects is shown to be a fundamental challenge for the cyclical nature of participatory monitoring, especially when its goal is shared agenda building. Another important conclusion is that, in the design of participatory processes, more attention should be devoted to providing stakeholders with the opportunity to comment on an 'intermediate' product.*

Based on: Frans Hermans, Wim Haarmann and John Dagevos, 2011. Evaluation of Stakeholder Participation in Monitoring Regional Sustainable Development. – Regional Environmental Change (29 March 2011), doi:10.1007/s10113-011-0216-y.

## 2.1 Introduction

A shift is occurring in traditional regional development strategies away from a top-down approach, towards more bottom-up approaches characterised by a decentralised style of policy making that also stimulates the horizontal ties between private and public bodies. At the same time, attention for the potential of each region to stimulate sustainable development is increasing (Pike et al., 2007). Adaptive co-management (Armitage et al., 2008), collaborative resources management (Danielsen et al., 2009) and the sustainable rural livelihoods approach (Chambers and Conway, 1992; Scoones, 2009) are just some examples of various bottom-up approaches that share a commitment to the participation of stakeholders, alongside concepts of social learning and sustainable development (Ridder and Pahl-Wostl, 2005; Stringer et al., 2006). A second element that these approaches have in common is their emphasis on the importance of monitoring and evaluation (Guijt, 2008; Reed et al., 2006).

In this chapter we will focus on participatory monitoring of sustainable development at the provincial level, which we will define as the systematic collection and analysis of information involving both scientists and regional stakeholders on issues related to regional sustainable development. The collected information consists of a set of indicators which measures the state of the regional socio-economic and ecological system. However, when we talk about monitoring regional sustainable development we are not so much interested in the assessment of how proposed policies are expected to influence the future state of the region. Rather, our interest focuses on identifying the most important characteristics that underlie the regional socio-economic and ecological system, determining the weaknesses that need to be improved upon, and the strengths that are deemed valuable and thus need to be conserved.

According to Cundill and Fabricius (2009) participatory monitoring can be used for two main purposes. The first purpose aims for a greater understanding of the regional system. It focuses on the integration of different types of variables and aims to create more awareness about possible future trajectories. This type of participatory monitoring is therefore closely related to the concept of participatory integrated assessment (Kasemir et al., 2003; Van Asselt and Rijkens-Klomp, 2002). The second type focuses on the promotion of social learning and stakeholder empowerment (Bohunovsky et al.; Leys and Vanclay, 2011; Weaver and Rotmans, 2006). In the latter case participatory monitoring is part of a wider process of shared strategic agenda building and starts from the question: where are we now and where would we like to go in the future?

Participatory monitoring can be used for one or both purposes at the same time. However, regional stakeholders can participate in different ways and these

different forms of involvement also influence the set up of the monitor. The main question this chapter addresses is: how can the participation of stakeholders in monitoring processes be evaluated and how do issues such as context, time and different designs of the participation process influence the outputs (the selection of sustainability indicators) and outcomes (learning and stakeholder relations)?

The chapter starts with a discussion of the concepts of stakeholder participation and monitoring. Subsequently we will present a framework to systematically evaluate stakeholder participation in monitoring. This framework will be applied to four different cases of participatory monitoring of regional sustainable development in the Netherlands. The four cases will be compared and we will explain how different contexts, purposes and participatory designs have led to different outputs and outcomes. The chapter ends with a discussion of the main findings and the conclusions.

## 2.2 Stakeholder participation in monitoring sustainable development

The need for stakeholder participation in monitoring stems directly from the subject we wish to monitor: (regional) sustainable development. Since sustainable development is a contested concept, it is by nature normative, subjective and ambiguous and its content cannot be determined by scientists alone (Grosskurth and Rotmans, 2005), there are no universal rules that govern all possible trade-offs in all possible circumstances. Monitoring sustainable development is therefore a political undertaking in which the meaning of the desired development itself has to be adapted with the help of participatory integrated assessments to specific regional circumstances (Hermans and Knippenberg, 2006).

Usually a stakeholder is defined as a person, organisation or group which is either affected by or may influence a problem or its solution. Stakeholders may perform two different roles in monitoring. First of all, since it is impossible to reach the whole regional population (who all have a stake in the sustainable development of the region), stakeholders can be chosen to represent a certain interest or segment of the population and thus help to identify the political issues that need monitoring. The second role of stakeholders is that of local or regional expert. This type of stakeholder possesses unique insights into the functioning of certain parts of the regional system due to their profession or experiences. It is important to note that we also include scientists in this last category. They may be asked to provide their specific expertise on the functioning of a certain (sub)system.

The use of stakeholders in assessments is not undisputed, however. Some authors question how far stakeholders can be trusted to correctly assess the complex environment in which they are immersed, to reach consensus, and how tendencies towards self interest can be tackled (Coglianese, 1999; Hacking and Guthrie, 2006). A general problem concerning stakeholder participation processes is that these tend to quickly lead to a 'unique' solution to a complex problem that is difficult to scale-up or apply in other contexts. By definition, given the subjective and normative nature of sustainability issues, the problem itself and its boundaries are unclear (Van de Kerkhof and Wieczorek, 2005). The generated outputs are only applicable to that specific moment in time, to the specific region and its characteristics and to the stakeholder groups that were involved. Applied to participatory monitoring, these issues raise questions in how far the participation of stakeholders in monitoring leads to differences in the results of participatory monitoring? To answer this question a systematic framework is needed to evaluate the participation of stakeholders in monitoring in the first place. In the next section we will introduce such a framework.

## 2.3 Evaluation of participatory monitoring processes

To evaluate stakeholder participation processes occurring in the participatory monitoring of regional sustainable development we have adapted the framework proposed by Burgess and Chilvers (2006). In this framework stakeholder participation processes are looked upon as having a series of *inputs, outputs and outcomes* within a certain *context*. These four basic elements are connected to each other both directly and indirectly (see Figure 2.1). We will discuss the different elements and how they apply to a participatory monitoring process below.

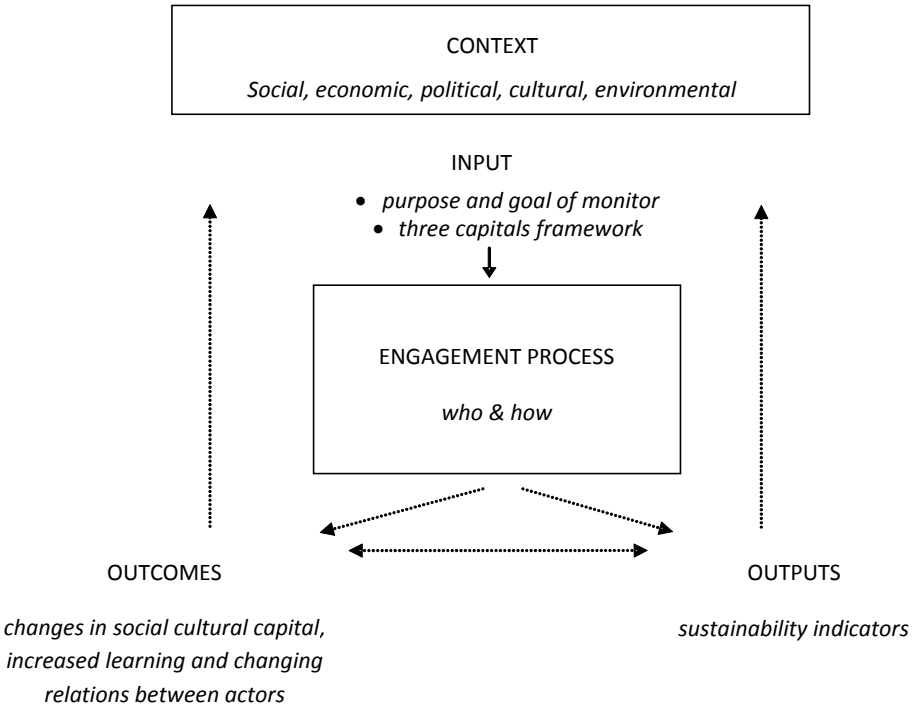



**Figure 2.1.** Contextual model of participatory monitoring processes (adapted from Burgess and Chilvers 2006)

## 2.3.1 The context level

The participation process is embedded in the contextual level and governance structure. This means that the participatory process is influenced by the context in which it takes place while it aims to bring about changes in this context at the same time (Pahl-Wostl et al., 2007). The context includes the biophysical and ecological circumstances and the slowly changing socio-economic characteristics of the region: its economic structure, its population and the cultural environment. As Pike et al. (2007) argue, regions are socially constructed spatial scales, where the political, social, cultural, ecological and economic processes relevant for regional development work across each other and between spatial scales. The existing social relations of the agents working within and across the regional scale and their previous experiences with participatory projects can be an important variable of the context (Innes and Booher, 2004). As context factors differ from region to region, the same participatory process may yield different results (Enserink et al., 2007).

### 2.3.2 Purpose and goal

The role and importance of stakeholder input varies according to the purpose of the monitor and its end users (Cundill and Fabricius, 2009; Danielsen et al., 2009). Participatory monitoring aimed at performance evaluation of the regional system will focus on obtaining insights into the relevant elements and their relationship to the regional system. Participation will be aimed at getting the right information into the process through consultation with the relevant stakeholders, while afterwards the stakeholders will be informed about the results of the monitor. However, in a monitoring process that aims for the creation of a shared vision in a process of social learning, the active involvement of stakeholders from the start is indispensable. Typically, people are brought together in workshops in order to discuss and jointly decide on the long term requirements and development objectives.

### 2.3.3 Engagement process

Rowe and Frewer (2005) use the flow of communication as a basis for classifying different forms of participation. The flow of information might be one-way: from sponsor to stakeholder (informing), or the other way around from stakeholder to sponsor (consultation), or two-way (active involvement). Key elements for successful interactive workshops are the quality of the participatory process and independence of the facilitators (Mayer, 1997; Mostert et al., 2007). The specific monitoring objectives influence the design of the stakeholder participation process but also the kind of stakeholder that needs to be involved. Using stakeholder analysis (Lindahl and Söderqvist, 2004), or actor analysis (Hermans and Thissen, 2009) relevant persons and organisations can be identified for each purpose.

During the engagement process stakeholders' opinions are elicited and debated in a structured way. In this section we will introduce the framework we have developed to structure stakeholder involvement and operationalise sustainable regional development at the same time. This framework is summarised in Figure 2.2. We will limit our discussion of this monitoring framework to its most important elements and how the input of stakeholders can be used to fill this framework. We refer interested readers to the more extensive discussion of this framework by Knippenberg et al. (2007).

Figure 2.2 shows the different elements of the sustainability monitor called the Sustainability Balance Sheet (or *'Duurzaamheidbalans'* in Dutch). Its set-up was inspired by the ScEnes model (Grosskurth and Rotmans, 2005) and the indicator system developed by Bossel (1996). We define sustainable regional development

as a balanced growth of the three capitals of sustainability: ecological capital, economic capital and socio-cultural capital (Hodge, 1997; Serageldin, 1996). In our view, sustainable development can be conceived as a development process aimed at fostering balanced growth in the resilience and quality of nature (the ecological capital), in the physical and spiritual wellbeing of people (the socio-cultural capital) and healthy economic development (the economic capital). By adopting this integrated approach, we explicitly choose to take a broad perspective on sustainable development. The concept, as we use it, has both a strategic dimension (the longer term), and a normative dimension (responsibilities devolving on various tiers of government, geographical regions and future generations).

Each of the three capitals consists of a set of 'stocks'[1]. Using soft systems modelling (Checkland and Scholes, 1990) these stocks are defined as subsystems that are important for the state and development of each capital as a whole. In order for the stocks to develop sustainably, they need to develop in a certain direction, towards a (sometimes utopian) target. Defining the long term requirements and targets is the most important step in developing the monitoring system. They form the heart of it. One or more indicators may be used to measure each requirement. The development of the indicators over time gives an insight into the direction of the development and the degree to which the requirements are met.

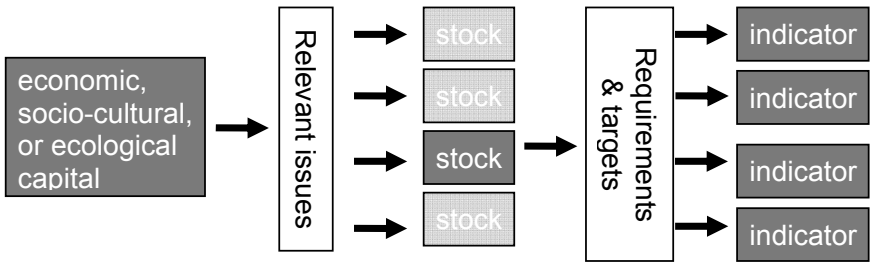



**Figure 2.2.** Monitoring framework to derive regional indicators

[1] The concepts in the framework have a distinct economic flavour: 'capitals', 'stocks' and 'balance sheet'. However, it is important to note that we do not express the indicators in a single economic value. Each indicator is measured in the units that are best suited to that particular indicator (and this is not necessarily money).

Stakeholder input can be used at all levels of the framework. First of all, stakeholder input can be used to define the relevant stocks of the regional socio-economic and ecological system that need to be optimised. Secondly, stakeholders can also be used to formulate the requirements and targets for each stock. By doing so the contours of a desirable future, the common shared dreams are defined. As this is a subjective and normative step stakeholder input is indispensable. Not all requirements can be satisfied at short notice and sometimes stakeholders are necessary to weigh the different requirements, indicators and stocks within the framework. Finally, stakeholders can be used to choose the indicators directly, or their opinions can be used as input at the indicator level. Examples of the latter are indicators that measure stakeholder satisfaction with the quality of the regional landscape or their perception of their influence on regional politics.

### 2.3.4 Outputs and outcomes

The effectiveness of a participatory process can be evaluated according to two criteria: outputs and outcomes. The reports, (computer) models and indicators that are included in the monitor form the outputs of the process. The process products such as the improved relations between participants through social learning and the development of trust between participants form the outcomes. These intangible relational qualities are also referred to as social capital (Coleman, 1988; Putnam, 2000). Outcomes and outputs are not completely independent of each other. For instance, the perception of the quality of outputs can affect stakeholders' acceptance of and satisfaction with the end result.

Unfortunately, the outcomes of participatory projects such as the changing relational bonds between stakeholders are very difficult to measure. First of all, the outcomes of participation processes may take several years to materialise, long after the project itself has ended. More importantly these participatory processes do not take place under laboratory conditions and therefore it is very difficult to disentangle the interdependent causal factors that may contribute to changing stakeholder relations and the development of trust in a process of social learning. Evaluations of the outcomes, therefore, often focus on what has been learned by the different participants, frequently using the concepts of organisational learning developed by Argyris and Schön (1978). Depending on the objectives of the monitoring exercise (performance monitoring or shared agenda building), the expected learning will change accordingly. Performance monitoring will most likely result in first loop learning by stakeholders about the regional system they are immersed in, while we would expect that monitoring with a focus on shared agenda building is more likely to result in a social learning process among those

stakeholders that will involve second loop learning effects where people will develop mutual understanding and a shared language with which to speak.

## 2.4 Case descriptions

We selected four different cases in which stakeholders were involved in constructing a sustainability monitor. These cases involve five different provinces in the Netherlands: Brabant, Zeeland, Limburg, Flevoland and Utrecht. The structure of the framework discussed above allows us to systematically describe these cases in terms of their outputs and outcomes. We have subsequently analysed the outputs in each case by comparing the collection of stocks, requirements and indicators that made up that particular Sustainability Balance Sheet. The outcomes were more difficult to assess, however. The description of the outcomes in all cases is based on our personal observations. Each of the three authors has been part of the technical team conducting the assessments of at least three of the four cases described and therefore we can compare these cases to each other on their outcomes and the effects of the learning processes taking place. In order to gain an indication as to the use of the monitor and its effects on regional policy (at the context level) we have investigated the follow-up projects carried out and examined references to the original monitoring project in other provincial documents and policies.

The first case, Noord-Brabant 2001-2002, will be described extensively, not only in terms of its participatory process but also in terms of its outputs and outcomes. The other cases are more or less variations on the original process design, so for these we will highlight only the most important differences in the process design. The different outputs and outcomes of the cases will be discussed as part of the cross-case analysis in section 2.5.

### 2.4.1 Sustainability Balance Sheet for the Province of Noord-Brabant (2001-2002)

#### Context and purpose

The idea for a provincial sustainability monitor in the Province of Noord-Brabant was conceived during an extensive strategic participatory project, initiated by the regional authorities of the Province of Noord-Brabant and aimed at defining what Brabant should look like in 2050. The result of this participation process was a long term vision that was formalised with the signing of a declaration by regional

administrators, dignitaries and stakeholder representatives called the 'Brabant Manifesto 2050'. Subsequently an independent organisation was founded, tasked with developing a provincial sustainability index that could monitor the progress towards this sustainability vision (Grijzen-Schreurs, 2005). This organisation was named Telos, the Greek word for 'end', 'purpose', or 'goal'.

## Input

A multidisciplinary group of researchers started to work on this assignment. After a year of intensive debates the three capital approach was chosen as the basis for the monitoring system and a first draft of stocks and requirements was made. The researchers decided that stakeholder involvement in the further development of the monitoring system was a 'conditio sine qua non'. Not only because of the nature of the concept of sustainability, intrinsic normative and subjective on the one hand and strategic on the other, but also because the forgoing process of developing the Brabant manifesto had shown the importance of getting the public involved in formulating a common strategy. Stakeholders were thus selected based on their knowledge of Brabant and their representativeness for segments of Brabant society. The group of stakeholders was completed by professionals from knowledge institutes and think tanks.

## Engagement process

Two workshops were organised in which this group of approximately 40 stakeholders was asked to reflect critically on the framework and to determine whether all the relevant issues relating to the sustainable development of Brabant had been covered. During the workshop stakeholders were divided into three subgroups each covering one of the capitals: ecological, economic and socio-cultural. The criteria used for grouping the people into the subgroups were their stake, expertise and background. In order to prevent stakeholders only talking about issues they were familiar with, a so-called carrousel method was used. The workshop was set up in four rounds. In the first round the stakeholders talked about their 'own capital', the issues they were most familiar with. In the second and the third round the subgroups were rotated and now they had to talk about the non-familiar issues in the other two capitals. In a plenary session the results of the carrousel discussions were presented and evaluated. The result of the first stakeholder meeting was a confirmation of the general framework while some issues were added, rearranged or renamed.

In a second workshop a start was made on the more technical aspects of indicator selection, data gathering, developing norms for the indicators and aggregation. The

same stakeholders were invited to this second meeting. In this second workshop stakeholders were also asked to weight the different stocks, requirements and indicators using a prioritising method. Stakeholders were also used to define the norms for indicators. They were asked to assign the ranges of indicator scores that represent a 'good' or a 'bad' situation. It was not possible to discuss all the indicators, but a number of general ideas were investigated.

**Outputs**

In 2001 the first sustainability balance sheet was published (Lemmens et al., 2001). This first version was presented as a concept version, a proof of principle. Over the following year a great deal of time and effort was put into presentations and public debates about the results and set-up of the monitor. In total 36 presentations were given to a range of stakeholders: political parties, non-governmental organisations (NGOs), schools and scientists. During these presentations the audience was also given the opportunity to weight stocks and indicators differently. After a year the results of this consultation round were evaluated, the framework adapted and a new round of data gathering started. One of the interesting findings of this round of consultation in which the audience was given the opportunity to weight the stocks, requirements and indicators was that ultimately there were no differences in the end results. In 2002 the new and improved monitor was published (Lemmens and Haarmann, 2002).

**Outcomes**

The first two sustainability balance sheets were generally considered to be very successful examples of provincial monitoring of sustainable development. This meant that there was a strong commitment to participate among the various stakeholder groups right from the start. The two workshops that were used to engage the stakeholders and fill in the indicator framework resulted in commitment and buy-in, not only within the provincial administration (government and civil servants) but also among participating regional NGOs. The workshops and the intensive communication both prior to and following the publication of the first draft of the Sustainability Balance Sheet, meant that the monitor and its trademark 'sustainability triangle' (a visual representation of the three capital approach) became a by-word in discussions on sustainable development in the Province of Noord-Brabant. One of the most important outcomes of the process of developing the monitor was the creation of a shared, common language which provided discussions on sustainable development with a neutral starting point that the diverse interests could all agree on (Dagevos and Te Poel, 2004). In the years

following the publication of the Sustainability Balance Sheet, several major provincial policy plans referred directly to the monitoring approach: the reconstruction plans for the intensive livestock sector (2001), the regional coalition agreement *'bestuursakkoord'* (2003) and the regional spatial development plan *'streekplan'* (2002).

### 2.4.2 Provinces of Zeeland, Limburg and Flevoland (2004)

The aim of the project was to investigate the possibilities offered by the SBS approach for comparing and benchmarking Dutch provinces with regard to issues of sustainable regional development. In each province a project team was formed comprising civil servants and a group of researchers.

The civil servants were responsible for selecting and inviting regional stakeholders to the workshops. Stakeholders were invited for their regional expertise and their position within the regional networks. The design of the engagement process was copied from the successful workshops previously held in Brabant. Two separate interactive workshops were organised in each of the three provinces. The first workshop was for civil servants from different provincial departments, covering more or less all the issues that the Sustainability Balance Sheet addresses. In the second workshop some 15 to 20 external provincial stakeholders were invited to reflect on the framework thus developed and add further important issues. In the next step, civil servants were responsible for gathering provincial data together with the project researchers who were also responsible for quality control and maintaining comparability of the frameworks between the provinces.

### 2.4.3 Sustainability Balance Sheet for Noord-Brabant (2006)

In 2006 the next monitoring cycle was started up for the sustainability balance sheet for Noord-Brabant. At his time, the development of a completely new sustainability vision was not given priority since the results of the extensive participation process four years earlier were considered to be relatively robust. The focus therefore shifted towards strengthening the underlying theoretical and analytical framework and making a comparison between the monitoring results from 2002 and from 2006: is Brabant making progress?

The SBS itself was discussed at a scientific working conference where international and national scientists, involved in monitoring sustainable development, were invited to discuss its set up and working method. Results from this conference were used to strengthen the framework and the following

engagement process. The set up and working method of the SBS was subsequently discussed with provincial civil servants in a separate workshop in order to improve the policy relevance of the monitor.

The other stakeholders were approached differently, however. Fifteen stakeholders were selected, based on their expertise and representativeness (five for each of the three capitals), and personally interviewed in depth about what they viewed as the most important future trends for sustainable provincial development. In an attempt to involve the general public and not just their representatives, an electronic survey was sent out to members of the so called 'Brabant Panel', (www.brabantpanel.nl). This online citizens panel involves citizens of Brabant, aged 16 and above. About 1240 people were asked to participate and approximately two thirds took part. The sustainability balance sheet 2006 was presented in December 2006 for an audience of stakeholders in the Province of Noord-Brabant (Hermans and Dagevos, 2006).

### 2.4.4 The State of Utrecht (2008)

The development of the 'State of Utrecht' provincial sustainability monitor was part of a larger process of long term vision development that the province of Utrecht started in 2008. The engagement process in this case included an initial stakeholder workshop, consultancy of the population of the Province of Utrecht through an online survey and a series of debates and presentations on the initial results. The participatory monitoring process was mainly organised by the Province of Utrecht itself. At the end of October 2008, a two day conference was organised under the name *'On the way towards 2040 together'* during which the first results of the sustainability monitor were presented as a so-called 'pre-pilot'. The sustainability monitor was presented as a possible guiding framework for discussions on sustainable regional development and as an indication of the present 'state of the province' with regard to socio-cultural, ecological and economic issues. The discussion surrounding the publication of the pre-pilot was instrumental in achieving acceptance of the final result. Both quality and public acceptance were enhanced in this process. Based on these discussions, the monitor was adapted slightly and filled with new data. Six months after the conference, the final version of the 'State of Utrecht' was published (Lukkenaer et al., 2009).

## 2.5 Cross-case analysis

The four cases are summarised in Table 2.1. They differ in their geographical context, monitoring purpose and the period during which the participatory monitoring process was conducted. In this section the outputs and the outcomes

**Table 2.1.** Assessment of stakeholder participation in different cases of participatory monitoring

| **Province (year)** | **Objectives** | **Participatory design** | **Stakeholders involved** | **Outputs** | **Outcomes** |
|---|---|---|---|---|---|
| Noord-Brabant (2001 & 2002) | Agenda building, social learning and stakeholder buy-in | a. Workshops with stakeholders to adapt monitoring framework<br>b. Debates on the framework and philosophy behind the monitor and the monitoring results | (provincial) NGOs, businesses, experts and politicians | A first framework. Analytical quality low: "wish list" of stocks, issues and indicators with a bias towards the specific regional situation in Brabant | Strong political support and commitment;<br>Learning effect: development of a common language between stakeholders. Wide acceptance of the monitor. |
| Flevoland, Zeeland & Limburg (2004) | Benchmarking and performance evaluation | a. Workshops with stakeholders to adapt monitoring framework to local circumstances<br>b. No debates | Provincial civil servants, NGOs and businesses | More generally applicable monitoring framework. Low comparability between provinces however. | Modest learning effects, limited to the project teams of civil servants directly involved |
| Noord-Brabant (2006) | Performance evaluation | a. Focus on stakeholder consultation in the form of interviews and a survey<br>b. Debates mainly focussed on the monitoring results themselves and the possibilities for action. | Provincial civil servants,<br>NGOs, businesses, scientists and Citizens | Stronger analytical framework showing developments over time and future challenges | Distrust of the results in the political arena.<br>Previous positive learning effects dissipated within the four years as regards the provincial administration |
| Utrecht (2008) | Agenda building, social learning and stakeholder buy-in | a. Workshops to adapt existing indicator framework to regional circumstances<br>b. Intensive post publication debates | Civil servants, NGOs, businesses<br>Politicians,<br>Citizens | Publication of "pre-pilot" before final publication of monitor. | Strong political support and commitment;<br>Learning effects: common language between stakeholders |

will be discussed in more detail in a cross-case comparison of the cases. We have analysed the indicator frameworks for the provinces of Brabant, Zeeland, Flevoland and Limburg to investigate the extent to which the differences in geographical context affect the outputs of the monitor. The effect of time will be analysed by making a comparison between the outputs generated by the monitor for Brabant 2002 with that for 2006. Finally, we will discuss how the

communication strategy surrounding the introduction of the monitor influences both the outputs and the outcomes.

## 2.5.1 The effect of geographical context on outputs and outcomes

The question how different geographical contexts influences the outputs of different participatory processes is difficult to answer. However, since the design of the engagement processes was essentially the same for the cases of Limburg, Flevoland and Zeeland and Brabant 2001, the assumption can be made that differences in indicator sets are the result of the differences in the regional contexts and not in differences in the participation method, or selection of stakeholders.

Figure 2.3 shows a comparison of the indicators sets that were developed in these four provinces. The figure shows that 174 different indicators were collected in the four provinces of which only 63 (or 36%) were present in all four monitors.

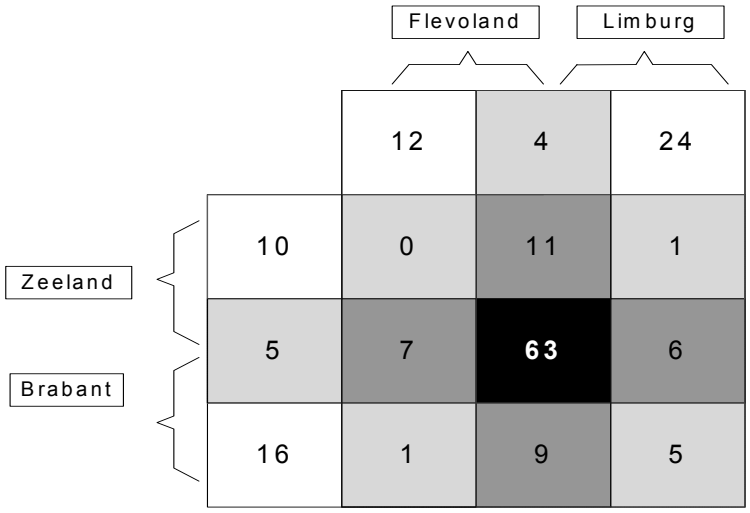



**Figure 2.3.** Venn diagram of the overlap between the four provincial sets of indicators. The darker the square the more provinces are included in the comparison: white squares show the number of unique indicators for one province; light grey the number of indicators that two provinces share; dark grey the number of indicators three provinces share and the black square shows the number of indicators that is shared by all four provinces (source: Haarmann et al., 2004)

From this figure we can conclude that differences in the historical development and the socio-economic and ecological conditions (summarised as geographical context) are in fact very important, even in a relatively small country as the

Netherlands. Figure 2.4 explains that the differences in indicator sets are in fact the result of the targets and requirements set by the stakeholders. Of the 79 aims that were formulated by the different stakeholders in the four provinces, only 23 (or 29%) were shared by all the four provinces. Different provinces are facing different challenges and different issues are therefore relevant to provincial stakeholders to be included in the monitor.

The outcomes in these cases were not so much influenced by contextual differences, but more by the intended purpose of the monitors. In the cases of Zeeland, Flevoland and Limburg we found only moderate effects on the social learning outcomes, especially compared to the case of Brabant (2001/2002). Single loop learning did occur, but was mostly limited to members of the project team itself. In this project there was a continuing struggle between the researchers who were also trying to preserve the comparability of the indicator frameworks and the desire on the part of the stakeholders to safeguard their own specific regional issues. Some stakeholders involved in the workshops also complained about abstract concepts used in the workshops. A useful comparison between the provinces on an overarching sustainability index, the main purpose of the project, turned out to be impossible as the comparisons discussed earlier in Figure 2.3 and Figure 2.4 showed.

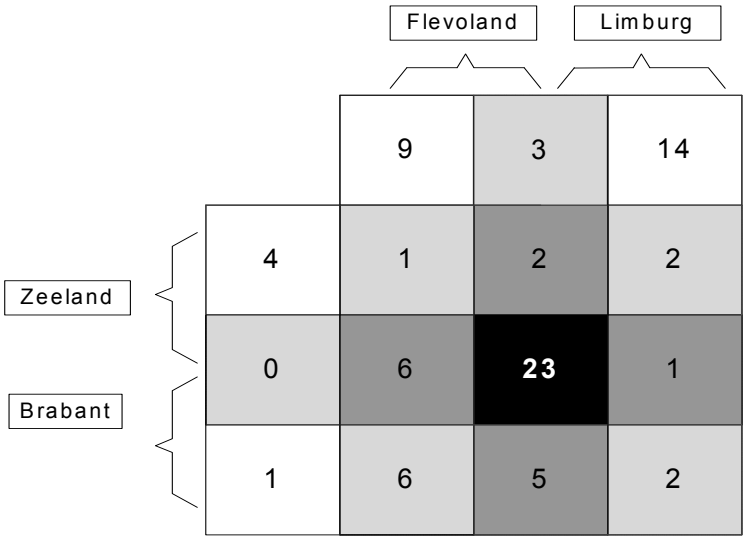



**Figure 2.4.** Venn diagram of the overlap between the four provincial aims and requirements. The darker the square the more provinces are included in the comparison: white squares show the number of unique aims for one province; light grey the number of aims that two provinces share; dark grey the number of aims three provinces share and the black square shows the number of aims that is shared by all four provinces (source: Haarmann et al., 2004)

### 2.5.2 The effect of time on outputs and outcomes

The question is whether time will affect the output of the monitor in the same way. As time goes on, some issues relating to the sustainable development of a region are resolved and disappear while others gain importance on the political agenda so that some influence on the output might be expected. A comparison between the Sustainability Balance Sheets for Brabant in 2002 and in 2006 showed that although stakeholder preferences did change over four years they did not change very significantly. The change in stakeholder preferences was reflected in certain issues being allocated a more prominent place in the framework and subsequently being allotted a higher weight. However, the rest of the regional structure remained largely the same, there was little change in their choices of other relevant issues.

We explain this result as the effect time has on the given socio-economic and ecological structure of a region. Particularly when the time period between two monitoring moments is short the influence of time can be expected to remain small. Regional structures change slowly except when major socio-economic and ecological crises take place. For instance in the period reviewed, as a result of a number of high profile accidents in the Netherlands together with the attention devoted to the threat of terrorism, attention for issues of public safety increased. These issues were thus deemed to be more important than four years earlier and were given a higher weight. Major external events were reflected in the way stakeholders weight different issues, but it did not change their preferences as to the choice of sustainability issues to be included.

The effect time has on the outcomes is far more important as the results of the Brabant 2006 monitor showed. The enthusiasm and learning effects that were achieved during the first extensive participatory processes in 2001 and 2002 had dissipated far more quickly than anticipated. Many people were now switching jobs which meant the positive outcomes of the first monitoring cycle partly disappeared with them. This was most visible within the provincial organisation in general and among the provincial governors in particular. This problem was aggravated by the departure within the provincial government of two of the main advocates of the monitor and its underlying philosophy. After all the work that had been carried out on the methodology of the SBS there was now a certain irony in discovering that, particularly at the political level, the monitor was being perceived as an unwanted legacy and a distrust of its results was being publicly shown.

The dissipating effects of social learning over the years proves to be a fundamental challenge for the cyclical nature of adaptive monitoring and the involvement of stakeholders, especially when its main goal is shared agenda building. As time goes on, participants leave the network and this leads to a fragmented group of ‘old’ and ‘new’ stakeholders in the network for the next cycle of the monitoring process. It is

difficult to do justice to the needs of the new stakeholders while at the same time trying not to completely ignore the existing visions already agreed on by the older participating stakeholders.

It is interesting in this context to review the experiences in Utrecht. Utrecht has organised a continuing stakeholder dialogue, by arranging an annual conference on an aspect of sustainable development. This way not the whole vision is discussed again, but only an aspect of the existing vision, that engages old and new stakeholders alike. It is too early to tell whether this will be a successful strategy and whether this approach can survive a change at the political level. However, we think this might prove to be an interesting option which could at least alleviate the problem.

### 2.5.3 The effect of communication on outcomes and outputs

Table 2.1 shows that the cases with the best outcomes (Brabant 2001/2002 and Utrecht 2008) formed part of a larger process of strategic agenda building. These cases were considered to be a success not only by the regional politicians but also by other stakeholder involved in the process. In a process of regional agenda building the relevant issues were discussed as well as the desired path of development, which issues should be monitored, how to weight them and what norms to use. These processes led to consensus over the way the shared vision could and should be measured. Later discussions on policy measures thus had a starting point that all participants had agreed on earlier.

The discussion above might lead one to conclude that participatory monitoring of sustainable development should always be made part of a larger process of agenda building. However, these two cases shared another similarity and that was the number of debates organised to communicate the monitoring results. In both cases extensive rounds of debates were organised around the publication of a ‘draft’ version (Brabant 2001) or a ‘pre-pilot’ (in Utrecht). This communication strategy proved to be very effective in improving the quality of the final product. Small mistakes were easily identified and sometimes better data were made available. At the same time stakeholder commitment and identification with the final end product was enhanced. Regional sustainable development can easily turn into confusing debates about relatively abstract principles. When some provisional results can be shown, it becomes easier to involve stakeholders and discussions can be structured with the help of the provisional results.

## 2.6 Discussion and conclusions

In this chapter we have looked at the effects different forms of stakeholder participation have on the monitor itself, its outputs (indicator sets) and the more intangible outcomes. We have found that significant improvements in both outputs and outcomes can be generated by debating an intermediate version of the monitor: this increases quality and at the same time enhances stakeholder commitment and acceptance of the end product.

We have found that contextual factors have a greater influence on the outputs of the sustainability monitor than time. The results show that when sustainability issues are selected by the stakeholders these then reflect the socio-economic and ecological structural characteristics of their region. In a different context, stakeholders not only assign different weights to the same set of issues, but more importantly they select a completely different set of regional aims altogether. In the same way as the structural characteristics of a region only change slowly, stakeholder preferences also change slowly. An important exception is the influence of external disturbances. A crisis does not necessarily lead to a completely new selection of sustainability issues by stakeholders but it does at least influence how they weight those issues.

Time does have a negative effect on the outcomes however. The dissipating effects of social learning over the years prove to be a fundamental challenge for the cyclical nature of adaptive monitoring and the involvement of stakeholders, especially when its goal is shared agenda building. A continuing stakeholder dialogue on aspects of the existing vision that engages old and new stakeholders alike might be an interesting option to alleviate this problem.

Finally, our own role in the monitoring process has changed. Over the years our independent status as researchers slowly dissolved and in all the cases we did outside Brabant, the provincial principals often had the final say in the organisation of the process and sometimes even in the publication of the end product. Even though our independent status was lost, in return we gained more political commitment to the monitoring process as politicians did not run the risk of being embarrassed by the reported results. This political commitment also increases the commitment of other provincial actors and civil servants to the process and since the openness of the process of constructing a monitor with stakeholders made it difficult for the political principals to interfere too significantly with the final end product, we found that the overall effect to be more positive than expected. In our opinion a bottom-up approach therefore cannot succeed without proper support from the highest political level.

# Chapter 3

# The Contested Redefinition of a Sustainable Countryside: Revisiting Frouws' Rurality Discourses

*This chapter gives an overview of the present day discourses on the sustainable development of Dutch agriculture. It aims to advance rural sociology by illustrating how these sustainability discourses actually contain completely opposing views of the future of the countryside. A qualitative analysis of interviews done with innovators in the agricultural sector indicates that the different discourses on the sustainable development of agriculture are a natural continuation of the different views of rurality previously identified by Jaap Frouws (1998). The redefinition of Dutch agriculture and the Dutch countryside is still contested; each discourse has its own vision on the sustainable development of the sector and the surrounding space. We conclude, therefore, that sustainable development has not functioned as an unifying concept to help different parties overcome their differences and work on win-win solutions. The sustainability agenda seems to have intensified an already slumbering difference of interests and perspectives, with the utilitarian, the agri-ruralist and the hedonist discourse each incorporating their own sustainability perspective. The hedonist and utilitarian discourses in particular aspire to sustainable agriculture on different scales and with opposing arguments. In a many respects they are polar opposites, and this has consequences for the possibility of bringing together stakeholders working towards sustainable agriculture.*

Based on: Frans Hermans, Ina Horlings, PJ Beers and Hans Mommaas (2009): The Contested Redefinition of a Sustainable Countryside: Revisiting Frouws' Rurality Discourses. – Sociologia Ruralis, 50(1): 46-63.

## 3.1 Introduction

The concepts of sustainable development and rurality, and their combination as either 'sustainable rural development' or 'sustainable agriculture' have been broadly discussed in the literature. These concepts may seem to be the same, but in fact each refers to a completely different set of ideas about agriculture and rural development, nature and landscape conservation, and the role of the actors involved: farmers, citizens, government and others (Cobb et al., 1999; De Haan et al., 1997; Pannell and Schilizzi, 1999; Tovey, 2008). Most of the time, sustainable agriculture focuses on farmers and on ecological conditions at the farm level, while sustainable rural development concerns itself with the wider regional scale and a broader range of actors (Murdoch et al., 2003). The preferred use of terms illustrates some of the underlying preferences of the parties who use them. In this chapter we try to bring some structure in this cacophony of voices by analysing the different discourses that people use to describe the different concepts of sustainable agriculture. Discourses are produced and reproduced by different groups and institutions in society, and change where these groups and institutions interact. The Dutch agricultural sector is our case in point. For decades the sector was dominated by a coalition of agrarian stakeholder groups which hegemonised Dutch rural policy (Frouws, 1993; Wisserhof, 2000). The main goal of this policy was to raise agricultural productivity in order to feed the quickly growing population, but also to finance, through export profits, the recovery of the country and its industry after World War II. In general, agricultural policy in The Netherlands was targeted at lowering the cost of agricultural products and increasing productivity through expansion, intensification and mechanisation (Van den Brink, 1990). However, from the 1970s onwards, with the increasing mobility of both city dwellers and farmers, the position of the countryside changed. More and more farmers found jobs in cities, and increasingly more people from the cities settled in the countryside. Thus, the traditional agrarian production function of the Dutch countryside faced an increasing competition from new functions such as housing and recreation. The growing concern for nature conservation and environment put even more pressure on the sector (Bekke and De Vries, 1994; Frouws and Van Tatenhove, 1993). In this chapter we study the different discourses on rurality, rural development and agriculture in the perspective of sustainable development. This is done in order to answer the question: what different discourses on sustainable rural development exist in The Netherlands? We will look at these discourses over time and in relation to one another. Although we focus on discourses in The Netherlands, this question can be related to the wider debate on sustainable, rural development in Europe as different rurality discourses also have different, sometimes conflicting, spatial expressions in the landscape. The shift towards specialised agricultural areas on the one hand and new suburbia where

agriculture is declining is not limited to the Dutch context alone (Van der Ploeg et al., 2008). We start with a discussion of some basic concepts underlying our theoretical perspective: the concepts of discourse, discourse coalitions and regimes. A lot of work has already been done on both the topics of sustainable development and rurality discourses, and we discuss some of them in the next section. These introductory remarks bring us to the actual methodology and qualitative analysis used in this study. Subsequently, we present the three sustainability discourses that resulted from our analysis and discuss how they are related to Frouws's rurality discourses. We conclude with a reflection on the dynamics of discourses on sustainable rural development over time. At this point we return to the notions of discourse coalitions and regimes and discuss the discourses and their dynamics identified in these terms.

## 3.2 Discourses, discourse coalitions and regimes

There are many definitions of 'discourse'. Here we define discourses as 'an organised set of social representations, the terms through which people understand, explain and articulate the complex social and physical environment in which they are immersed' (Frouws, 1998). There is a debate whether 'the practices that result when these beliefs are acted upon' should also be included in the definition of a discourse (Arts and Buizer, 2009). This would be in accordance with the often quoted definition of Hajer (1995, 2006). Language games can be a part of this practice, but the practice is not necessarily limited to language games as such. We acknowledge the strong relationship between the linguistic aspects and the practices supporting and reproducing them. However, in this chapter we confine our definition of a discourse to the communicative aspects involved, in line with Frouws's definition. This limited definition is more in accordance with the qualitative analysis of interviews we have carried out. Discourses are revealed in the language people and organisations use. They are expressed on both group and institutional levels and can be linked to the networks of the different groups of people or organisations using them: discourse coalitions. The key actors of a discourse coalition have decisive influence on which issues are deemed relevant for discussion (Hajer, 2006). By the language they use they can predetermine the direction in which possible solutions are sought. Discourses are dynamic: they change over time. As new factions rise to power their discourse can become dominant: more and more people start using it and ultimately it becomes part of institutions and organisational practices (Hajer, 2006). In The Netherlands after World War II the agricultural sector was the exclusive domain of a discourse coalition consisting of civil servants from the Ministry for Agriculture, farmers' representatives, parliamentary agricultural specialists and a growing section of

knowledge professionals. Their shared objective to develop a modern, competitive, export-oriented agricultural sector was rarely questioned (Wisserhof, 2000). When a specific discourse coalition has risen to dominance over its domain, it becomes reminiscent to the concept of 'regime', which can be seen as a configuration of political and societal coalitions and institutions, their discourse and the practices that structure specific parts of society. The concept of regimes is used in various lines of research, for instance those of policy arrangements (Arts and Leroy, 2006; Van Tatenhove et al., 2000); urban political studies (Stoker, 1995; Stone, 1993); and innovation and transition studies (Geels, 2004; Rip and Kemp, 1998). A distinction is made between regimes as socio-technical systems (Rip and Kemp, 1998) and as societal systems, that is, sectors or regional entities (Rotmans, 2003). See Horlings et al. (2006; 2009) for an overview of uses of the concept of a regime in these different lines of research. While emphasising the different characteristics of regimes, these lines of research also share some common elements. First of all, a regime implies a long-term coalition of (groups of) actors such as citizens, politicians or other social groups. Secondly, these groups of people share a set of rules for approaching things and situations. These rules can be reflected in material objects, like physical technologies and infrastructure, but also in non-material rules for acceptable behaviour. Finally, a regime implies some form of collective knowledge and a vision or agenda towards the future. Even though not all terms will mean exactly the same thing to all groups of people in a regime there is an assumption among the different parties of a common understanding of rules, problems and possible solutions (Hajer, 2006). This collective knowledge can be found empirically through intermediaries like texts, practices and technologies (Stuiver, 2008) and this brings us back to our current study: discourses on sustainable agriculture and sustainable rural development. In the next section an overview of existing studies of discourses in the field of sustainable and rural development will be given.

## 3.3 Discourses on sustainable rural development

Both concepts of rurality and sustainable development have attracted their fair share of reviews and analyses. We will start with a short review of the concept of sustainable development and later in this section show how this concept is applied on agriculture and rural development. The most often quoted definition of the concept of sustainable development is derived from the report 'Our Common Future', by the World Commission on Environment and Development and was formulated as: 'development that meets the needs of the current generation without compromising the ability of future generations to meet their own needs' (World Commission on Environment and Development, 1988). This 'Brundtland

definition' of sustainable development has been called intrinsically ambiguous, subjective and normative (Rotmans et al., 2001a). The concept has been analysed in terms of justice (within generations) and resilience (between generations), but there is no fixed relationship between those two and there are no universal rules for evaluating sustainable development (Hermans and Knippenberg, 2006). It is therefore unsurprising that the number of definitions and views on the subject has mushroomed (Mebratu, 1998; Robinson, 2004). In the end sustainable development was advocated as a useful boundary object, a concept that could bring together different parties who did not agree on the exact meaning of the term, but for whom there was enough overlap to allow for a process of social learning, trust building and consensus formation between stakeholders working on complex problems under uncertain conditions (Cash et al., 2003; Leeuwis and Pyburn, 2002; Röling and Wagemakers, 1998). Or formulated slightly differently: 'Sustainable development is a normative and political concept, and to a high degree its value has to be sought precisely in the fact that it is contestable.' (Jacobs, 1999; pp. 25-26). In an attempt to bring some order in the debate about the concept of sustainable development, Dobson (1996) developed a typology for four different kinds of sustainability: very weak, weak, strong and 'absurdly strong' sustainability, depending on the trade-offs allowed between man-made capital and natural capital. Dobson's typology has certain characteristics that we can also find back in some other publications, such as the relationship of man versus nature (human centred or eco-centred development approaches) and differences in the assessment of nature's vulnerability (Janssen, 2002; Thompson et al., 1990). However, he does not define his typology as a set of different discourses. To enable a discursive approach, the concept of sustainability has been placed in a wider societal context (Dryzek, 1997; Fischer and Hajer, 1999). Discourse analysis thus identifies sustainability as a specific environmental discourse. Dryzek's classification of environmental discourses is based on two elements: (1) the extent of departure from the (dominant) industrialist thinking and (2) the type of assessment of the political-economic situation. The departure from the industrialist discourse can be reformist or radical. The first means that only some of the negative aspects of industrialisation need to be fixed or mitigated, while the second is based on the belief that the current earth system's health is precarious and the limits to the earth's ecological carrying capacity have already been crossed, requiring a large-scale intervention. The second dimension of Dryzek's classification is concerned with perceptions of the political-economic situation. Prosaic discourses see environmental problems as things that require action, however, they do not require a new kind of society. In contrast, imaginative discourses seek to completely redefine the current situation. The environment is brought into the heart of society rather than being seen as an external source of problems. Existing societal structures are subject of debate and win-win solutions are sought to change these

institutions. In Dryzek's classification, sustainability is thus labelled as an environmental discourse that seeks imaginative solutions to environmental and societal problems, without completely rejecting the industrial structure of modern society. Nowadays, however, the sustainability cloak has also been claimed by the other environmental discourses. In fact, the distinctions that Dryzek makes are equally applicable to sustainability discourses themselves (see Table 3.1).

**Table 3.1.** Classification of sustainability discourses

| | **Attitude towards industrialisation** | |
|---|---|---|
| | Radical | Reformist |
| **Place of environment** | | |
| Imaginative | Green radicalism | Ecological modernisation |
| Prosaic | Survivalism | Problem solving |

*(adapted from Dryzek, 1997, page 14)*

The classification of sustainability discourses enables us to study the concept of sustainability in the context of agriculture and rural development. If sustainability already an intensely debated issue in its own right, the associated confusion is hardly resolved when it is applied to certain sectors or practices, as exemplified by societal debates about sustainable agriculture. Even though the agricultural sector already featured prominently in the report by the Brundtland Commission, there is still no consensus about the meaning, scales and boundaries of sustainable agriculture. Terry Marsden (2003) linked rural development to sustainable development issues by analysing three distinct agrarian production models on a European scale. Though Marsden refers to policy models, his line of thought is relevant here, because the models he identified (the agro-industrial model, the post-productivist model and the rural development model) are based on different discourses. The agro-industrial model is associated with the globalised production of standardised products. It reflects the faith in free competition and the application of technology intensive solutions that reduce input costs through economies of scale. The post-productivist model is based on the belief that the agricultural sector (in developed economies) is small and decreasing in economic relevance. The rural landscape becomes a consumption good for the urban population, marginalising agriculture in the process. Marsden argues that both the agro-industrial and the post-productivist model have severely unsustainable traits. To deal with these unsustainable models, he proposes a new way of looking at rurality: the rural development model. He presents sustainable rural development as an attempt to define agriculture as a multifunctional set of practices that has the potential to enhance the relation between farms and people, both within rural areas and

between rural and urban areas (Sonnino et al., 2008). Derived from agro-ecology, this model refers to ecological management of biological systems through collective forms of social action that address the needs of both society and nature without jeopardising the integrity of either. Marsden's approach sets itself apart from Dobson's and Dryzek's in that it introduces a component of scale specific to agriculture, whereas the others discuss sustainable development in general terms only. However, he has been criticised for suggesting that the content of the term sustainability is not contested and that only his theoretical notion of rural development dynamics can be called sustainable (Wolsink, 2004). Jaap Frouws (1998), like Marsden, also took the rural area as his point of interest, studying it from a discourse analysis perspective. However, his analysis is focused on the different competing concepts of rurality, without reference to the notion of sustainable development. Frouws makes a distinction between three Dutch discourses on rural areas: the traditional agri-ruralist discourse, the neo-liberal utilitarian discourse and the hedonist discourse. The last contains the agenda of animal welfare activists combined with nature conservationists and the recreational sector. We have summarised the main characteristics of these discourses in Table 3.2.

**Table 3.2.** Overview of rurality discourses

| | **Ontology** | **Agency** | **Motivation** | **Natural relationships** |
|---|---|---|---|---|
| | *What entities focused on?* | *Who has principal capacity to act?* | *Primary reasons for action?* | *Primary relationship between entities* |
| **Agri-ruralist** | Farmers (and their family) | Agricultural sector and the state | Traditional values | Farmer as custodian of nature and landscape |
| **Utilitarianist** | Consumers and producers | Market parties: Enterprises and local governments | Material self-interest | Market relations, Nature and landscape only as production values |
| **Hedonist** | Tourists, city dwellers, animals | People in networks | Pleasure seeking, self fulfilment | Nature and biodiversity have intrinsic value. Mutual agreement |

*(adapted from Frouws, 1998)*

The focus of each of these discourses differs from farmers, to entrepreneurs, to city dwellers. Likewise, the reasons for action and the relationships between entities differ between the discourses (Dryzek and Berejikian, 1993). So far, we have identified a general sustainability discourse as such, which is part of an extended societal environmental debate and two slightly different analyses of existing

rurality discourses. Although Marsden does not explicitly refer to his typology as discourses, the implication is that in each of his models a distinctive discourse will be present. However, a problem with Marsden's analysis is that his vision of sustainability is limited to that of the newly emerging rural development model. The other two are inherently unsustainable in his view. Frouws on the other hand, showed an interesting analysis of perspectives on the countryside, specifically for The Netherlands, but never linked this to issues of sustainable development. This brings us to the main question of this research chapter: what different discourses on sustainable rural development can be identified in The Netherlands?

## 3.4 Method

To analyse the discourses in the Dutch agricultural sector a qualitative analysis was done. Thirteen stakeholders were interviewed following a semi-structured interview protocol.

### 3.4.1 Research context

The study took place in the context of the Dutch innovation programme TransForum. TransForum is aimed at bringing about a sustainable transition in agriculture and green space. It establishes relations between actors with innovative ideas, in order to promote unconventional innovations, generate knowledge in order to achieve system innovations for a more sustainable agri-food sector and vital rural areas. In order to achieve its goals, it involves relevant key players from knowledge institutes, governmental bodies, civil society organisations and the business community. See the introduction (section 1.6) or Veldkamp et al. (2009) for a more extended review of the TransForum working method.

### 3.4.2 Participants

All participants were stakeholders in an innovation project to improve Dutch agricultural sustainability. They were selected for the interviews because of their involvement in these projects, their overview of the sector and their role as opinion leaders. Ten of the interviewees were engaged in TransForum projects on sustainable agriculture and three additional respondents were active in the province of Noord-Brabant on projects regarding rural development and regional branding. The selection contained a diverse set of stakeholders: people from within the sector like farmers, but also stakeholders with (in)direct connections to the sector: trade

organisations, the food processing industry and scientists. The only sector not covered in the interviews was the intensive pig production sector. To redress this gap, views on (and stemming from) the intensive pig production sector were taken from the reports 'Dialogues on sustainable agriculture' (Borgstein et al., 2007; Brasser et al., 2007).

### 3.4.3 Procedure

Interviews were conducted using a semi-structured interviewing format with six main topics for discussion:

1. The future of the agricultural sector in The Netherlands
2. The current situation and interviewees' analysis of the most important problems
3. The definition of sustainable agriculture and the criteria for operationalising this definition
4. The role of the government in sustainable agriculture
5. The role of research and technology for sustainable agriculture
6. The co-operation between the different parties in the project, and the role of the project leader.

The questions were not strictly adhered to but functioned more or less as a checklist to see whether all the relevant topics were covered in the discussion. The interviews were conducted by two different individuals separately. Interviews took place between June 2007 and March 2008 and took between an hour and an hour and a half.

### 3.4.4 Analysis

Analysis of the interview results was done in accordance with the grounded theory approach (Glaser and Strauss, 1967; Strauss, 1987). The interviews were cut into segments and the segments were labelled using an open coding method. An iterative procedure was used to categorise and code each segment. Firstly, the main analyst coded the entire body of segments, which took about a month. After that the independent second analyst, who was not involved in doing the interviews in the earlier phase, reviewed the analysis and offered questions and comments. These questions and comments were addressed, after which the main analyst resolved in the analysis any points that could not be addressed through discussion. This procedure was iterated until the second analyst agreed completely with all codes and categorisations. The analysis took a total of three rounds to complete. In the

final step different codes were categorised and linked to each other. Already during the first steps of the analysis it became clear that some of the statements could be linked directly, sometimes almost verbatim, to elements of the three discourses identified by Jaap Frouws. These three main rural discourses (agri-ruralist, utilitarian and hedonist) have therefore been used to structure the categories. As we will show, the identified sustainability issues could also be linked to elements of existing discourses.

## 3.5 Results

The three discourses differ in their appreciation of the current situation, problem analysis, future trends, preferred solutions and visions for the agricultural sector. The role of different actors and more specifically the role of government also differs substantially between discourses. Below we will discuss the three discourses and link each of them to the issues of sustainability.

### 3.5.1 The agri-ruralist discourse

The agri-ruralist discourse contains the more traditional view of the agricultural sector. The discourse coalition consists of crop farmers, parts of the dairy farming sector and the poultry sector. A large part of agricultural representatives and traditional agrarian politicians are also still part of it. The ideal type of agriculture is provided by the family unit, because of its associated positive values and side effects, for instance on animal welfare:

> *On family farms, there is always somebody present to look after the animals and it is not just a nine-to-five job. This will increase the farmers identification with the animals and thus also his care for them.*

Although the current situation of the agricultural sector always leaves something to be desired, the perspective for the future of the agricultural sector in The Netherlands is reasonably positive. The problems identified do not have much to do with the sector itself, but more with outsiders' perceptions of it: bad public relations and communication have weakened its societal acceptance. Examples are the media coverage of the epidemics of swine fever and mad cow disease. These epidemics, and, more importantly, the bad public relations stemming from them, have to be avoided in the future. In general, it is acknowledged that the non-agrarian public demands on the sector will not disappear and the agrarian sector should work to meet some of these demands by re-establishing and maintaining its licence-to-produce. Multifunctional agriculture, with the farmer in the role of custodian of the landscape, is seen as important for a sustainability-oriented

solution. Not only can this form of agriculture function as an escape route for the cost-price squeeze (Van der Ploeg, 2000) but it is also perceived as an important tool to improve the social acceptance of the sector. Technology is important and the sector should definitely be involved in working on innovations, mainly to cut costs but also to remain interesting in terms of employment. However there is a clear limit to the involvement of technology. The big agro-industrial developments are seen as a threat to the family style of production. Agro-industrial production should take place in the countryside and not on big anonymous industrial zones:

> *I don't believe in these big agro-industrial complexes in industrial zones. That kind of thinking tips the scales in the wrong direction. The nice thing about the Dutch model is that it's a combination of red and green elements.*

With the increase of non-agrarian actors in the rural debate, the national government also started to promote other interests; more specifically ecological and environmental concerns. The perceived problem with the government is that it has multiple conflicting goals and no clear choices are made: 'government should direct more, make clearer choices between competing claims'. In general, government, and especially the national government, is seen as part of the problem and not part of the solution. A new development in the agri-ruralist discourse is the growing attention paid to new forms of co-operation and self-steering by farmers and farmer's organisations as a solution to break through this perceived inflexibility of the government (Horlings, 1997).

### 3.5.2 Sustainable agriculture in the agri-ruralist discourse

In the agri-ruralist discourse, sustainability is directly linked to the family farm scale and, more specifically, to the continuity of the farm. A statement like: 'sustainability means that your son or daughter is eager to take over the farm', is an example of this type of reasoning. There is also a strong feeling of personal involvement with sustainability in this discourse. This has to do with the individual sense of stewardship: 'Sustainability has to do with stewardship: you are responsible for things around you and you should treat everything with respect without trying to absolutely maximise your gains'. This image fits with farmers as the custodians of the countryside, with a special responsibility for the environment under in their care. The long-term perspective is given priority over short-term profits and sustainability in its broader sense is defined in terms of the social acceptance of the agricultural sector. Sustainability is a means to improve the sector's social acceptance and its 'licence to produce': 'Sustainable agriculture has to solve a number of technical problems on the one hand, and at the same time it has to provide social acceptance'.

### 3.5.3 The utilitarian discourse

This discourse has a strong neoliberal focus on the economic dimension and international competitiveness in global markets. The utilitarian discourse is no longer the discourse of only economists and real estate developers but includes now also agricultural businesses, particularly high-tech sectors such as the horticultural sector and parts of the intensive pig farming sector. The current situation is seen as somewhat problematic since not all agricultural sectors face good prospects. The future of the sector is impaired by the perceived trend of an ever-increasing price of land in a densely occupied delta area. These high prices make it difficult to compete with other, less densely populated countries. A major difference between the utilitarian and the agri-ruralist discourse is that this discourse puts economic dynamics first and is prepared to face the consequences: not all types of agriculture will be able to survive in The Netherlands. The main problem of the sector, according to this utilitarian discourse, is the lack of an entrepreneurial drive. The sector has not yet been able to adjust to the demands of the markets properly: 'There is a lot of artisanal competence within the sector, but not enough entrepreneurial skills'. In contrast with the agri-ruralist discourse, the utilitarian discourse sees the family farm as a sign of the underdevelopment of the sector and as a clear sign of the lack of entrepreneurial skills in it. Successful competition on the world market is an important goal. The utilitarian discourse has a strong entrepreneurial drive: it is not important to produce the primary products yourself and others might be able to do this better. As long as producers can add value to the international supply chain by means of their own technical know-how or managerial skills it is still possible to be a successful actor in the sector. Management of production chains is therefore identified as an important possible future perspective. There is a clear but limited role of the (national) government in ensuring a level playing field, not only on the national level, but more importantly also on the international level. Government measures which threaten a smooth functioning of markets, and/or the competitiveness of the Dutch agricultural sector are seen as threats. Government and the general public sometimes make it difficult to compete on the global markets by insisting on meeting soft criteria which threaten this level playing field.

The role of science and technology is stressed for increasing competitiveness. Because the possibility of increasing scale is more and more limited in The Netherlands, the solution is to apply more efficient and cleaner technologies. Examples are genetically modified organisms, but also the clustering of activities based on principles of industrial ecology and the integration of production chains.

### 3.5.4 Sustainable agriculture in the utilitarian discourse

Sustainable agriculture in the utilitarian discourse is defined well within the limits of the market. The foremost concerns are cost-price efficiency and they define what is possible in terms of environmental measures: 'Whatever sustainability ambitions will be formulated, cost-price will be the most important aspect for all cases'. Unlike the agri-ruralist discourse which places a lot of emphasis on farmers' personal commitment to sustainability, in the utilitarian discourse the leading role for change is placed on the consumer: 'The key for sustainability lies with the consumer'. Consumers who are provided with more information and a wider choice of options are more aware of and better equipped to make decisions in buying sustainable food products: 'Consumers have the power to pull new sustainable products through the production chain'. The utilitarian discourse has a strong international perspective on sustainability. A growing world population makes it necessary to increase food production and (new) technology is therefore a natural answer to this and other problems. Through technology intensification outputs can increase, while at the same time environmental pressures decrease. Sustainability opportunities are concentrated around a smarter organisation of production chains, either horizontally (a more eco-efficient integration of production processes) or vertically (a more eco-efficient organisation of the life cycle of products).

### 3.5.5 The hedonist discourse

The hedonist discourse stands for a network approach that brings together various local and regional actors from inside and outside the agricultural sector. The hedonist discourse nowadays includes more than just the urban elite looking for self-fulfilment in the countryside. The discourse coalition has grown and no longer includes only recreational actors and landscape conservationists but also health NGOs, organisations working on regional branding and slow food activists. Farmers are thus seen as just one of the many actors that should be involved in rural development. This discourse says that the current agrarian practice is in serious trouble. Examples are the different crises confronting the sector in the past years: epidemics of swine fever, mad cow disease and the threat of the Asian bird flu, complemented by the ongoing environmental degradation and more specifically the further degradation of the Dutch landscape. The answer to these problems is to break away from current practices and focus on regional development: more tourism, recreation and other services, more attention to landscape maintenance, more diversity of production methods, organic farming and more attention to animal and human welfare. Communication is once again a very

important instrument, however, the function of communication is not to educate people about all the positive contributions the sector makes, but the other way around. The aim is to involve new groups of people, more specifically, urban citizenconsumers, in the regional development of the neighbouring countryside:

> *Ultimately citizens should be able to hold shares in a farm. That way they are automatically more involved in the production process. They should also be able to come by and harvest their own potatoes.*

Regionalisation of production and consumption are seen as important solutions to improve the regional economy: 'We want to make the region more important and stimulate people to enjoy the region'. Regional branding of agricultural products together with recreation and tourism are natural combinations: 'Recreation and tourism are crucial. When there is a good connection between the city and the countryside, this will create opportunities'. Although the hedonist discourse is associated with bottom-up participation processes, it does not mean that the local and provincial government should not take a leading role in organising and facilitating such networks. Strong and visionary politicians are necessary to break through administrative barriers and make these networks function better. Whereas in the agri-ruralist discourse there is some distrust of government parties, in the hedonist discourse government, and especially regional and local government branches are seen as natural partners to co-operate with. There is some serious doubt on the ability of new technology to solve the current crises. There is a sense, especially with regard to the intensive animal husbandry, that ongoing technological development is to blame for the predicament of the sector. The continuing exploitation of pigs, hens and cows in the bio-industry is a problem that cannot be solved by using ever more technology.

### 3.5.6 Sustainable agriculture in the hedonist discourse

The image of sustainable agriculture in the hedonist discourse is more diffuse than in to the other two discourses, because this discourse also includes the broadest range of actors. These different actors have different interests: both the urban need for green consumption landscapes for recreation, and concerns for animal welfare and landscape conservationism can be found here. This also results in different visions of sustainable agriculture: 'Sustainable agriculture is about the quality of the landscape of future generations' but also: 'The ambition for the future is to make the intensive pig farming, more animal friendly'. Sustainable rural development thus becomes a very broad notion. However, within this discourse, these different elements are seen as complementing each other: the involvement of new actors in the countryside through tourism and recreation gives new economic opportunities for farmers and medium- and small-scale industries. Landscape

quality enhances these opportunities and the same applies to extensive forms of farming and attention to animal welfare. This does not mean that all the different perspectives and opinions held by parties of this discourse coalition are completely covered by this discourse. Rather it means that the hedonist discourse on sustainable rural development borrows bits and pieces from each of these separate discourses and mixes them into a more or less coherent new view of the countryside. Within the hedonist discourse some of the institutional actors, such as the farmers' representatives, are perceived as being opposed to changes that threaten the status quo. The existing institutional configuration of the agricultural sector is therefore part of the problem:

> *This sector has too much institutionalisation, with the Ministry of Agriculture, farmer unions, greenhouse owners, etc., etc. That makes changing things not only time consuming but also difficult if you try to involve them all.*

## 3.6 Discussion

Ten years ago Frouws observed the breaking apart of the Dutch national agricultural development regime by an increasing struggle between diversifying interests that resulted in the emergence of two alternative rurality discourses and their associated discourse coalitions. Nowadays we are witnessing a further diversification of interest and coalitions, all under the umbrella of the concept of sustainable agricultural development. Although Dutch discourses on agricultural and rural development have all incorporated the concept of sustainability, they have all done so with a specific configuration of economic, ecological and social interests that sometimes exclude each other. The participants interviewed all agreed that changes are necessary to provide for a more sustainable future of the agricultural sector in The Netherlands. However, opinions differed on who and what has to change and how these changes should be implemented. The hedonist and utilitarian sustainability discourses are to a certain extent polar opposites. It seems that the agri-ruralist discourse is stuck in the middle, with the possibility of dissolving into the other two over time. Through globalisation and the integration of the European agricultural markets the utilitarian discourse is slowly replacing the family farm model on the one hand, leading to large, intensive farms searching for space in the contested countryside. On the other hand we see a discourse coalition consisting of members of the urban population, landscape conservationist and animal welfare activists steadily growing on the regional level. Rural development is no longer the exclusive domain of farmers. They are one of the partners in this discourse but they are often not the most important one and they run the risk of becoming marginalised. On a practical level our results put some limits on the possibility of achieving consensus in participatory projects aiming for

sustainability through social learning and that involve stakeholders derived from the hedonist and utilitarian discourse, as they have almost nothing in common in terms of their frame of reference. For example, the location of a mega-stable in The Netherlands, as expression of the utilitarian sustainability discourse, led to fierce protests of citizens in 2007 and 2008, and ultimately a 'dialogue of the deaf' (Termeer et al., 2009). Not only does this impede the chances for a constructive dialogue between the two on a practical level, it also challenges the possibility that a single new sustainable agricultural regime on the national level will eventually emerge. In specific geographical locations on a regional level, some of these discourse coalitions may stabilise and then may successfully shape policies for a longer period of time. In that case the urban regime theory (Stoker, 1995; Stone, 1989, 1993), may also be extended to apply on these rural regimes. See for instance the case of Heuvelland in the south of The Netherlands for the description of a regional regime agenda that might be associated with the hedonist discourse (Mommaas and Janssen, 2008). By using qualitative analysis: breaking interviews into segments and then making categories and new storylines out of them, some of the richness of the original interviews has been lost. The discourses identified are therefore to a certain degree a caricature of the more extended and nuanced ideas that groups of people express. We do not think that in reality everyone can be easily categorised into one of these three very broad classes. Individuals can combine elements of different discourses or are able to speak in different voices depending on their role (Akkerman et al., 2006). This is particularly true for the hedonist discourse, with its wide range of actors. We do not argue that all the actors in the hedonist discourse are perfect representatives of the whole hedonist discourse; however, we argue that these different parties posses parts that amounts to an overarching hedonist discourse that stand clearly apart from the other two identified discourses. Finally, we have found a striking aversion among the participants interviewed to organic farming: 'Organic farming is no solution because it does not produce enough food' was an argument that was often made. This attitude is may be the result of the fact that the market share of organic products in The Netherlands is still rather small (2.1 per cent in 2008) (Brouwer and Vink, 2008). However, it is surprising that even in the hedonistic discourse the organic farming approach has not gained much traction. We can partly explain this result by the bias in our study, which was based on the agricultural innovation projects of TransForum. With hindsight we have established that TransForum's portfolio lacks organic farming projects. We therefore recommend that a future investigation focuses on entangling the place of organic farming in hedonist discourse. At the moment it seems that organic farming is viewed as a solution to supplement other solutions, but not as a solution in its own right for the whole agricultural sector.

## 3.7 Conclusion

Much of our work supports the original typology identified by Frouws, although both the discourses and the coalitions related to them, have shifted somewhat. Developments in multifunctional farming, industrial ecology and landscape preservation can be seen as a sustainability perspective in an already existing development strategy. Discourses on sustainable agriculture are a natural extension of existing rurality discourses. The utilitarian, the agri-ruralist and the hedonist discourse have incorporated their own sustainability perspective, which excludes each other to a large extent. The results show that under the umbrella of sustainable development there is an intensified struggle over the future of the Dutch countryside. The concept of sustainable agriculture has not lead to a unified overarching vision for the future. On the contrary, the hedonist discourse and the utilitarian discourse seem to be polar opposites, with the agri-ruralist discourse being stuck in the middle. As the hedonist and utilitarian discourse have almost nothing in common in terms of their frame of reference we do not expect the tensions in the Dutch countryside to disappear in the near future. In the meantime, the challenge lies in finding a new fit between diversifying rural interests, spatial planning and economic activities in the densely populated Dutch delta.

# Chapter 4

# Assessing Sustainability Perspectives in Rural Innovation Projects using Q-Methodology

*In this chapter we investigate the different perspectives of sustainable agriculture held by participants of a Dutch innovation program called TransForum. Using Q-methodology we have systematically elicited individual perspectives on agricultural innovation and extracted their common elements. We have compared these perspectives with existing discourses of rural and sustainable development. Our results show that the use of technology and the agricultural production function of rural landscapes are among the two most contested elements between perspectives. The more radical perspectives reject technology and support a multifunctional landscape in the countryside, while the prosaic perspectives do the complete opposite with a positive attitude towards technology and a preference of the use of the countryside for agricultural production alone. Surprisingly an ecological modernisation perspective of sustainable agriculture is missing. In this chapter we propose the concept of 'metropolitan agriculture' to fill this void.*

Based on: Frans Hermans, Kasper Kok, PJ Beers and Tom Veldkamp: Assessing sustainability perspectives in rural innovation projects using Q-methodology. – Sociologia Ruralis (in press).

## 4.1 Introduction

Agricultural practices in The Netherlands have come under more and more pressure from a range of different sources: space claims from the urban population, economic pressures from trade liberalisation and increasing attention for animal welfare and environmental degradation. This has resulted in calls for a fundamental break from current practices towards more sustainable forms of agriculture (Van der Ploeg et al., 2004; Van Latesteijn et al., 2008). Guiding visions of long-term sustainability goals are of great importance in this transition process as they can inhibit or spur the acceptance of innovations (Beers et al., 2010). Given the inherent difficulty of steering innovations and transitions, transition theory emphasises the importance of initiating a whole range of innovation projects, each with different visions of sustainability. This 'basket of images' as Loorbach and Rotmans (2006; p. 200) have called it, can contain complementing but also contradiction or competing visions.

In this chapter we will investigate an innovation programme to see what is actually inside such a 'basket' when it comes to transitions towards a more sustainable agricultural sector. What visions can be discerned and how do these visions differ or overlap each other? More importantly, where do they differ from existing societal discourses on rurality and sustainable agriculture? Investigating these front-runners can provide some insight into the direction modern agriculture is heading.

This chapter starts with an overview of existing discourses on rurality and sustainable development. Subsequently we will introduce the Dutch innovation programme of TransForum and its working method. We will discuss Q-methodology as our particular method of choice to investigate the perspectives of participants in TransForum's innovative projects. Boonstra (2006; p. 147) has referred to this method as 'a methodological middle-ground' that introduces a quantitative component into interpretive approaches such a discourse analysis. Q-methodology allows us to systematically compare perspectives and link them to existing societal discourses. In the discussion we discuss these results and their meaning for innovations and sustainable agriculture in general. The chapter ends with the conclusions.

## 4.2 Discourse analysis of sustainable development and sustainable agriculture

In this chapter we use discourse analysis to investigate the visions for rural development and sustainable agriculture. The concept of discourse is

conceptualised differently in different research traditions. Van den Brink and Metze (2006) make a useful distinction between discourse as 'frame of reference' and discourse as 'language in use'. The first perspective studies discourse as an individual belief system that is more or less stable. The perspective that studies discourses as 'language in use', takes another perspective: meaning is given to social and physical phenomena through a set of identifiable practices (Hajer, 1995).

In this chapter we use the first perspective and define a discourse as the shared language groups of people have in common, or formulated differently: '*a discourse is an organised set of social representations, the terms through which people understand, explain and articulate the complex social and physical environment in which they are immersed'* (Frouws 1998; p. 56). This definition therefore excludes actual practices and takes the individual as a basis for investigation.

Discourse analysis has been particularly useful analysing the visions that underlie the different definitions and approaches to sustainable development. Sustainable development has been analysed as a particular environmental discourse closely related to ecological modernisation theory (Dryzek, 1997; Hajer, 1995). The application of Q-methodology in a number of studies that involve different aspects of sustainability showed however, that sustainability discourses are no longer limited to ecological modernisation alone, but that other environmental discourses have also incorporated the concept of sustainability (Addams and Proops, 2000; Barry and Proops, 1999; Steelman and Maguire, 1999; Swedeen, 2006). The criteria that Dryzek (1997) uses to distinguish environmental discourses have already been discussed in chapter 3, however they form such an important context for some of the discussions later to follow in this chapter, that we will nonetheless discuss them here again.

**Table 4.1.** Classification of sustainability discourses

| | **Attitude towards industrialisation** | |
|---|---|---|
| | Radical | Reformist |
| **Place of environment** | | |
| Imaginative | Green radicalism | Ecological modernisation |
| Prosaic | Survivalism | Problem solving |

*(adapted from Dryzek, 1997, page 14)*

Table 4.1 shows the classification of sustainability discourses again. Sustainability discourses can be classified firstly by how they view industrialisation and secondly by how they place the environment within the current political context. The attitude towards the industrialist discourse can be either 'reformist' or 'radical'. The first

means that only some of the negative aspects of industrialisation need to be fixed or mitigated, while the second is based on the belief that the current earth system's health is precarious and the limits to the earth's ecological carrying capacity have already been crossed, requiring a large-scale intervention. The second dimension of a sustainability discourse is concerned with the place of the environment within the political-economic realm. 'Prosaic' discourses see environmental problems as requiring action but not a completely new kind of society. In contrast, 'imaginative' discourses seek to completely redefine the current situation. The environment is brought into the heart of society rather than being seen as an external source of problems. Existing societal structures are subject of debate and 'win-win' solutions are sought to change institutions.

Following Zografos we will base our analysis of general rurality discourses on the work of Jaap Frouws and our own analysis of these rurality discourses presented in chapter 3. These three particular agricultural and rural discourses: the 'agri-ruralist discourse', the 'utilitarian discourse' and the 'hedonist discourse' provide three distinct visions of agriculture and sustainable rural development. In the remainder of this chapter we will investigate what elements of these rurality discourses can be found in the innovation projects of TransForum.

## 4.3 Method: Q-methodology

We used Q-methodology to operationalise the sustainability discourses within the rural innovation projects of TransForum. The innovation programme of TransForum and its link to transition theory has already been described in the introduction of this thesis (see section 1.6) and therefore we will limit ourselves here to a description of Q-methodology.

Q-methodology is an increasingly popular method to systematically elicit individual perspectives and to analyse the overlap and differences between them using quantitative correlation analysis. Although most uses of Q-methodology limit themselves to identifying the groups and their shared perspective, the method also allows to test hypotheses in a more quantitative way (Brown, 1980; McKeown and Thomas, 1988).

Q-methodology differs in important ways from the more common social science methodologies that measure attitudes through surveys and questionnaires. The first difference is that concepts do not depend on previously constructed scales that measure some predetermined traits of respondents in the way surveys and questionnaires are usually constructed. This means that in Q-methodology respondents are doing the measuring, instead of being measured. Participants are thus allowed to 'to speak for themselves' by performing a Q-sort (Dryzek and

Berejikian, 1993; p.49). At the same time it acknowledges two issues that are rarely raised in surveys and questionnaires: firstly that the same words or phrases may actually mean different things to different persons and secondly that most people understand certain statements within the context of other statements that are included in a questionnaire. Finally Q-methodology is based on the principle that subjective points of view are communicable and that they are recognisable as such. Previte et al. (2007) argue that these characteristics make this method especially suitable as a research tool for contemporary rural researchers since it acknowledges the multiple versions of reality that are experienced by the various actors involved in the countryside.

Early applications of Q-methodology in rural research at first focused on identifying the different perspectives of groups of farmers: their different goals and management styles (Fairweather and Keating, 1994) or their views on environmental issues (Davies and Hodge, 2007). Later, the perspectives of other rural actors were also included. Zografos (2007) investigated rurality discourses using Q-methodology in Scotland, focusing specifically on actors in the network of Scottish Developments Trusts. This shows that Q-methodology is not completely unknown in the field of rural studies. However, since this method does not belong (yet) to the standard tool of many social scientists, we will describe the seven different steps that it takes to execute a Q-methodology study in some more detail in the following paragraphs.

*Step 1: Generating the communication concourse*

The first step is the construction of a concourse: this should be a collection of all possible statements about the issue at hand. The collected set of statements should be both diverse and comprehensive: it should capture the complete range of perspectives that different groups of stakeholders might have. For the concourse on sustainable agriculture, we used the interviews conducted with ten representatives of TransForum projects and three agriculture innovation projects that were not directly linked to TransForum (see chapter 3, section 3.4.3 for the details of the interview procedure). The interviews were segmented and statements were categorised and labelled according to their topic.

This collection of statements was enriched with two more sources:

- The results of a workshop on sustainable agriculture organised by TransForum
- Literature: the report of a number of workshops with representatives of the different agricultural sectors (Borgstein et al., 2007; Brasser et al., 2007).

The result was a concourse of over 400 statements, at which point no new categories were found and the collection process was halted.

*Step 2: Set-up of the Q-sort*

A concourse of 400 statements is too large to let respondents react to and usually a smaller number between 30 and 64 statements is deemed an appropriate size of statements that respondents can still cope with. The selection of statements from the concourse is therefore an important activity in Q-methodology. McKeown and Thomas (1988) make a distinction between structured and unstructured sampling of statements from the concourse. For our study we used a structured sampling matrix that was built on the three rurality discourses identified by Frouws (1998) and our own study described in chapter 3, linking these three discourses to sustainability issues. Table 4.2 shows the concourse matrix and its categories. The numbers refer to the number of statements selected for each category. Not all categories were equally present in the concourse, especially regarding sustainability and this left fewer statements in a specific category compared to the other two discourses. Covering all possible topics was more important to us than forcing an equal amount of statements over the discourse elements.

**Table 4.2.** Concourse matrix with amount of statements selected in each category

| | **Agri-ruralist** | **Utilitarian** | **Hedonist** |
|---|---|---|---|
| Current situation | 1 | 1 | 1 |
| Main problem | 3 | 3 | 3 |
| Solutions | 2 | 2 | 2 |
| Trends | 1 | 1 | 1 |
| Government role | 1 | 1 | 1 |
| Technology | 1 | 1 | 1 |
| Vision | 2 | 1 | 2 |
| Sustainable agriculture | 5 | 4 | 3 |
| Total statements | 16 | 14 | 14 |

*Step 3: Selection of respondents*

In contrast to regular survey methods, the quality of a Q-methodology study depends less on the size of the sample of respondents, and more on the breadth of possible perspectives captured in the sample. In our study the respondents originated from a broad spectrum of TransForum projects, as Table 4.3 shows. Although not all innovative projects were covered (some had already finished by the time we started our study), most projects at least have one person included in the sample and the coverage of the innovative projects makes the assumption that no important perspectives are missing fair. Some people are involved in more than one innovative project, which explains the difference between the number of respondents (36) and the total number of people in Table 4.3.

*Step 4: Ranking the statements by respondents: the Q-sort*

Respondents were asked to sort the 44 statements on a grid containing 44 cells, ranging from -4 (most) disagree with to +4 (most) agree with, see Figure 4.1. As is common in Q-methodology the grid forces respondents to sort the statements in a fixed distribution: allowing the least amount of statements (3) in the most extreme categories (in this case +4 and -4) in order to find the statements that characterise the perspective the most.

The Q-sort was performed on-line with the use of the FlashQ software (version 1.0) (Hackert and Braehler, 2007), a shareware program freely available on the internet. The statements were randomised for each participant separately.

**Table 4.3.** Response per innovative project

| Project | Respondents | Response % |
|---|---|---|
| The Sjalon | 3 | 100.0% |
| Greencare | 3 | 100.0% |
| Greenport Venlo | 3 | 100.0% |
| Healthy with Oats | 2 | 66.7% |
| Northern Frisian Woods | 6 | 54.5% |
| Flor-i-log orchestration | 2 | 50.0% |
| Sustainability in Retail | 2 | 50.0% |
| Regional food chains | 2 | 50.0% |
| New Mixed Farm | 6 | 46.2% |
| Scientific monitors | 4 | 44.4% |
| Healthy Pip-fruit chain | 2 | 33.3% |
| Laying Hen Husbandry | 1 | 33.3% |
| Dairy Adventure | 1 | 20.0% |
| New markets and vital coalitions South Limburg | 2 | 16.7% |
| Brackish agriculture on Texel | 1 | Unknown |
| Biopark Gent-Terneuzen | 1 | Unknown |
| SynErgie | 0 | 0.0% |
| Everything About Food | 0 | 0.0% |
| Calendula | 0 | 0.0% |
| Overall | 41 | 47.7% |

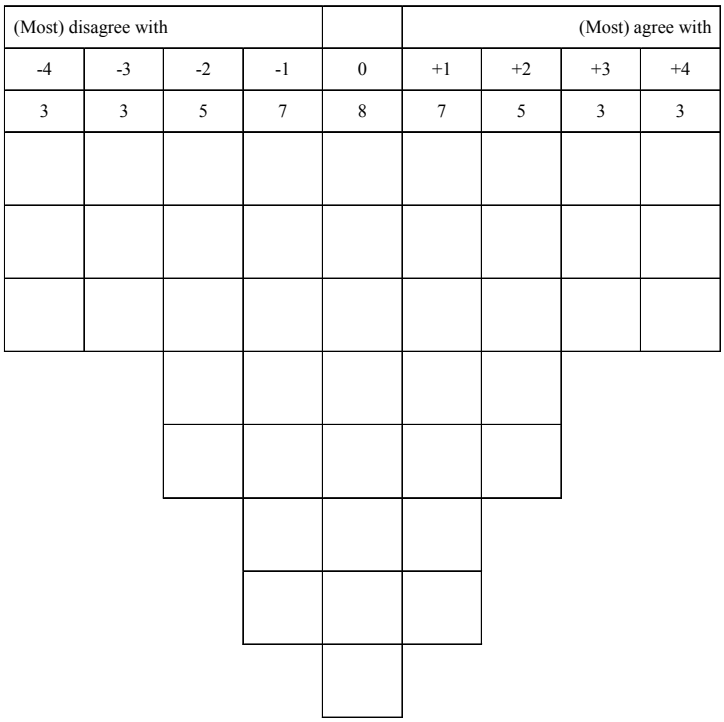



**Figure 4.1.** Response grid

### *Step 5: Factor analysis*

Data analysis was performed using PQMethod (version 2.11) and SPSS (version 16.0). The first program is specifically designed to analyse data generated by Q-sorts (Schmolck, 2002). A principle component analysis (PCA) was executed to rearrange the data by identifying and ordering components and ranking them according to the amount of variance that they explain of the original data. The subsequent data reduction is done by choosing an appropriate number of components and discarding the rest. Brown (1980) gives an overview of various criteria that can be used to help with the decision on the amount of components to retain. Applying this range of criteria on our dataset showed that the number of relevant components varies with the criteria used, with a minimum of two, the result of parallel analysis (O'Connor, 2000), and a maximum of eleven (eigenvalues exceeding 1). We decided for a pragmatic combination of criteria based in part also on an analysis of what additional information an additional component offered. This led us to include four factors.

The four factors combined explain 47% of the total variance, see Table 4.4. Factors were rotated using the orthogonal varimax technique in order to minimise the number of high loadings on each factor, making the interpretation of the factors easier. The total of explained variance (communality) remains the same, but the variance per factor may change during this procedure. The resulting factor loadings were interpreted based on their significance level[2] (at $p < 0.01$, significance level 0.389). Of the 36 Q-sorts entered, 33 were found to load significantly on at least one factor. Three persons did not load on any factor. Five persons loaded on more than one factor and this is consistent with the theoretical notion that people can have a nuanced view that combines different elements of two or more discourses.

**Table 4.4.** Number of loaders and variances of the four factors

| | **Factor A** | **Factor B** | **Factor C** | **Factor D** |
|---|---|---|---|---|
| No. of respondents loading | 14 | 10 | 8 | 6 |
| Variance explained (after rotation) | 17% | 12% | 10% | 8% |

Of the five confounded loadings, two were confounded between factor A and factor C, and 2 were confounded between factor B and factor D, the remaining one scored significantly on factor A and negatively on factor D. This is consistent with the correlations scores between the factors depicted in Table 4.5. High correlations were found between factors A and C ($r = .56$) and between factors B and D ($r = .49$), indicating that there is some overlap between these visions.

**Table 4.5.** Correlations between factor scores

| | **Factor A** | **Factor B** | **Factor C** | **Factor D** |
|---|---|---|---|---|
| Factor A | 1 | 0.22 | 0.56 | 0.03 |
| Factor B | 0.22 | 1 | 0.25 | 0.49 |
| Factor C | 0.56 | 0.25 | 1 | 0.11 |
| Factor D | 0.03 | 0.49 | 0.11 | 1 |

[2] Significance level $p < 0.01$ calculated as: 2,58 * standard error (SE); with $SE = 1/\sqrt{(\text{number of statements})}$

**Table 4.6.** Statement scores for each factor

| Nr. | Dis-course | Statement | Factor A | | Factor B | | Factor C | | Factor D | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Q-sort score | z-score | Q-sort score | z-score | Q-sort score | z-score | Q-sort score | z-score |
| 1 | A | Agriculture and horticulture have perspective within Dutch society. | 0 | 0.11 | **2** | **1.16** | **4** | **1.93** | 1 | 0.51 |
| 2 | A | The biggest problem is that the perception of consumers does not correspond with reality. | -2 | -1.05 | **3** | **1.27** | 1 | 0.68 | 2 | 0.63 |
| 3 | A | The problem with many Dutch agricultural products is that they are located at the bottom of the market, where competition is only possible on price and volume. | **0** | **0.27** | -1 | -0.41 | -1 | -0.56 | **2** | **0.80** |
| 4 | A | The Dutch agricultural sector lacks a director and a clear direction at the moment. | -1 | -0.37 | 0 | 0.30 | **-3** | **-1.36** | 1 | 0.48 |
| 5 | A | New product-market combinations, such as the combination of discovery of nature and care farms, are rising. | 3 | 1.42 | **-1** | **-0.23** | 3 | 1.11 | **-2** | **-0.82** |
| 6 | A | In this highly developed market, you, as a producer, have to equip your products with surplus value. | 2 | 0.99 | **4** | **1.53** | 2 | 1.02 | 2 | 0.66 |
| 7 | A | Openness of production is important. You should be able to visit a farm at all times. | 0 | 0.20 | **-2** | **-0.80** | 0 | -0.01 | -1 | -0.27 |
| 8 | A | You have to gain credit to be allowed to operate an agricultural business, not only by working for the consumer, but also for the landscape and society as a whole. | 3 | 1.27 | **-2** | **-0.97** | 3 | 1.25 | 3 | 1.48 |
| 9 | A | You don't want to depend completely on foreign countries for your food production. | 1 | 0.61 | 1 | 0.55 | 2 | 0.96 | 0 | 0.31 |
| 10 | A | The thinking in large agribusiness parks on big industrial estates is going too far. | -1 | -0.33 | **-4** | **-1.84** | **0** | **0.17** | -2 | -0.77 |
| 11 | A | Government should steer more clearly between different goals. There is a need for more vision, and more decisive decision making. | 2 | 0.66 | 1 | 0.59 | **-1** | **-0.53** | 2 | 0.75 |
| 12 | A | The long term perspective is the most important, even if that goes -for the moment- at the expense of profits. | **4** | **1.78** | 1 | 0.48 | 0 | 0.05 | **-1** | **-0.62** |
| 13 | A | Sustainability means that your child is eager to take over the farm. | -1 | -0.75 | -3 | -1.21 | -1 | -0.90 | -4 | -1.60 |
| 14 | A | Sustainable agriculture should solve a number of technical problems and at the same time work on societal acceptance. | 2 | 0.82 | **3** | **1.37** | 0 | 0.17 | 1 | 0.53 |
| 15 | A | Sustainability is connected with stewardship, you have to treat everything with respect. | 4 | 1.59 | 4 | 1.47 | 0 | 0.18 | 0 | -0.19 |
| 16 | A | Retailers have a lot of power, but unfortunately they still have a very limited interest in sustainability. | 1 | 0.62 | 0 | 0.15 | 1 | 0.37 | **-2** | **-0.73** |
| 17 | U | It's questionable whether we should produce something like wheat in the Netherlands. Space has become too limited for that. | **-1** | **-0.7** | -3 | -1.50 | -1 | -0.61 | -4 | -1.84 |
| 18 | U | There is a lot of artisanal knowledge available in the primary sector, but entrepreneurial skills lack. | **-2** | **-0.87** | **-3** | **-1.49** | **0** | **0.26** | **3** | **1.29** |
| 19 | U | An important bottleneck is comprised of competition distorting measures, such as welfare measures, prescriptions of means and production licenses. | **-4** | **-1.90** | -1 | -0.67 | -2 | -1.12 | -2 | -1.05 |
| 20 | U | The agricultural sector has depended on the family farm mode of production for too long. | -2 | -0.78 | 0 | 0.18 | -2 | -1.02 | 0 | 0.01 |

**Table 4.6.** *continued*

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 21 | U | There will be a selection of agricultural activities by spatial efficiency: land prices will be leading. | -1 | -0.50 | 0 | -0.13 | -1 | -0.45 | 1 | 0.31 |
| 22 | U | We have to seek our perspective in creating economies of scale. The basic relationship remains efficiently using labour and mechanisation. | **-3** | **-1.09** | 1 | 0.51 | **-4** | **-1.64** | 3 | 0.90 |
| 23 | U | There is no future in bulk production. Within the Netherlands you have to try to manage the supply chains abroad. | 1 | 0.33 | 1 | 0.53 | **-3** | **-1.35** | **-1** | **-0.44** |
| 24 | U | One of the most important ambitions is the preservation and the re-enforcement of the agricultural sector for global competition. | -3 | -1.62 | 0 | -0.02 | -4 | -1.68 | 0 | <0.01 |
| 25 | U | New technology will increase productivity and competitiveness on the world market. | **0** | **-0.18** | **2** | **0.97** | **-2** | **-0.98** | **4** | **1.87** |
| 26 | U | Government should formulate criteria and conditions and give entrepreneurs their room. | **1** | **0.50** | 2 | 1.20 | 1 | 0.94 | **4** | **2.02** |
| 27 | U | Whatever sustainability ambitions are formulated, in all cases cost price will be the most important aspect. | **-4** | **-1.83** | 1 | 0.55 | **-2** | **-0.92** | 1 | 0.62 |
| 28 | U | An organic production method can never produce enough food for everybody. | **-4** | **-1.97** | 3 | 1.24 | 2 | 0.94 | 1 | 0.44 |
| 29 | U | The key for sustainability lies with consumers. | -2 | -0.82 | -1 | -0.45 | **0** | **0.17** | -1 | -0.63 |
| 30 | U | Sustainability means that the same output is generated with less input of harmful means and methods. The level of technology should therefore increase. | **-1** | **-0.55** | **2** | **1.14** | **-2** | **-1.03** | **4** | **2.14** |
| 31 | H | The Dutch agricultural sector is in crisis and should radically alter its course. | -2 | -0.88 | -2 | -0.87 | **-3** | **-1.57** | -1 | -0.43 |
| 32 | H | The big cities don't pay enough attention to their own back yard, the countryside. | 1 | 0.47 | -1 | -0.64 | 1 | 0.44 | -2 | -0.72 |
| 33 | H | There is a devastation of landscape going on. | -1 | -0.66 | -4 | -2.08 | -1 | -0.24 | -4 | -1.96 |
| 34 | H | There is an overly organised institutional infrastructure within the agricultural sector. That makes implementing new things difficult. | 0 | -0.12 | 2 | 0.99 | 3 | 1.22 | 0 | 0.16 |
| 35 | H | There will be an increasing demand for regional products because consumers have more confidence in regional producers. | **0** | **0.22** | **-1** | **-0.74** | **1** | **0.69** | **-3** | **-1.33** |
| 36 | H | Recreation and tourism are very important. A good relationship between cities and rural areas will generate new chances. | 2 | 0.91 | 0 | 0.04 | 4 | 1.31 | -1 | -0.38 |
| 37 | H | Landscape has a value that you should try to market. | 1 | 0.49 | **-1** | **-0.79** | 2 | 0.96 | 2 | 0.83 |
| 38 | H | The ambition for the future has to be increasing animal welfare in husbandry. | **2** | **1.11** | 0 | -0.16 | 0 | -0.22 | 0 | -0.06 |
| 39 | H | The goal is to develop a strong region, not only economically but also socially. | 4 | 1.85 | 0 | 0.15 | 4 | 1.61 | 1 | 0.57 |
| 40 | H | You can't solve all problems with new technology. | **3** | **1.31** | 1 | 0.78 | 1 | 0.79 | **-3** | **-1.61** |
| 41 | H | Government should deploy more projects with small actors. | **0** | **-0.04** | -2 | -0.92 | -1 | -0.89 | **-3** | **-1.52** |
| 42 | H | Sustainability means caring for the quality of the landscape for coming generations. | 0 | 0.31 | **-2** | **-1.03** | 1 | 0.63 | 0 | 0.24 |
| 43 | H | It's pointless to start a discussion on the seasonality of agricultural products. Those are attainments of consumers. | -3 | -1.22 | -4 | -1.62 | -4 | -1.72 | **-1** | **-0.47** |
| 44 | H | Sustainable agriculture should have a modern design that bridges the contrast between industrial and organic farming. | 1 | 0.38 | 4 | 1.43 | 2 | 0.98 | 0 | -0.08 |

Notes: discourse: A: Agri-ruralist; U: Utilitarian; H: Hedonist
Bold Q-sort scores or z-scores indicate a 'distinguishing statement': the difference with all other factors is significant at $p<0.05$

*Step 6: Interpretation of factor scores*

The Q-sorts of the people who significantly loaded on a specific factor were used to calculate a weighted average for the statements. The higher the load of a person's Q-sort, the heavier we counted it in the weighted average. Since not all factors contain the same number of respondents, the statement factors are normalised by calculation of a standard z-score for the purpose of comparing them. Table 4.6 presents these z-scores for each statement together with their corresponding position on the response grid (from -4 to +4).

To facilitate the interpretation, the most 'distinguishing statements' of each factor are calculated: those statements of a factor that are placed on a significantly different location on the Q-sort grid (calculated at the $p<0.05$ level). These statements are thus the most indicative of the unique perspective captured by the factor. However, it is important to note that the other statements also contain information that is useful for the interpretation of the factor scores, even though they may also be present in the other perspectives to a certain extent. We used both the distinguishing statements and any relevant other statements for the interpretation of the factor scores below.

***Factor A: Progressive farmers***

*Socially accepted agriculture with a long-term perspective*

The importance of societal acceptance of agricultural activities is the first defining aspect of this perspective (statement 12). Criticisms of past agricultural practices with the intensification and on-going mechanisation are recognised and embraced (st.22). The negative perception of consumers is therefore rightly deserved, especially considering the lack of attention for animal welfare, which should be a priority (st.38). These measures are not considered to be distorting market competition as the rejection of statement 19 indicates. Market considerations are generally not viewed positively in this perspective (st.24 & 27).

Solutions are sought in broadening agricultural activities to increase societal acceptance: the possibilities of organic farming (st.28), the development of new product-market combinations (st.5), and recreation and tourism (st.36) are all valued positively. Technology is regarded ambiguously, since it can be blamed for the bad image of the sector and development of new technology is not positive *per se* (st.40). Again social acceptance is key here, new technology should be beneficial for increasing societal acceptance of the sector (st.14).

This perspective has a strong commitment to the farming lifestyle and this is linked to a sense of personal responsibility, the notion of stewardship (st.15) and the region they themselves operate in (st.39). Farmers are considered to be good

entrepreneurs who can be trusted to solve their own problems (st.18). The role of the government is to set clear rules and limitations and let the sector go about its business (st.26).

### *Factor B: Conservative farmers*

*The countryside is first and foremost for agricultural production*

Practical business thinking and technology are the central elements of this perspective. The countryside is first and foremost intended as the agricultural production space it always was. It is not meant as a recreational space for the urban population (st.32), and the high-tech production environment of modern agriculture does not allow for much openness (st.7). Almost all statements that deal with the role of landscape in the countryside are viewed negatively: (st.33, 37 & 42).

There is an awareness of the problems that can occur when the social acceptability of the sector and its production methods declines (st.44 & 14). Consumers have a bad image of the sector and this is perceived as a problem (st.2). Whereas the perspective captured by factor A is engaging society and its diversifying demands on the agricultural sector, the perspective in Factor B is about the exact opposite: the first instinct is to turn away from society (st.8). Instead legitimacy is sought through a strong economic performance of the sector (st.6). The role of modern agriculture is to produce cheap and plentiful food for global markets. Technology is compatible with this view: it raises productivity and can at the same time reduce environmental pressures (st.25). Large-scale agribusiness parks, within the countryside, are the future of the sector (st.11). Other modes of production that are not compatible with this vision are not viewed positively: (st.28, st.5 &st.35).

There is a practical farmer's perspective present here: personal responsibility is important and the attention to cost prices is an inevitable part of the daily routine (st.27). There is a certain amount of trust in the future of the sector (st.1). There are enough chances in the market and farmers generally have the entrepreneurial skills to make use of these chances (st.18). The role of the government is to set the rules and criteria and then give the entrepreneurs their freedom (st.26).

### *Factor C: Regional development professionals*

*Rural development for the region, by the region*

The countryside and not farmers take central stage in this perspective. The future of the countryside looks very bright (st.1 & 31) because it holds a lot of promise for new product-market combinations that can be connected with new regional activities: care farms (st.5) recreation and tourism (st.36), and attention for

landscape (st.37). These new functions also create new market opportunities, and they contribute to regional development.

Farmers are just one of the actors that have a stake in these developments. However, practical agrarian considerations like long-term profitability or personal stewardship are either absent or evaluated negatively (st.12 & 27), making this a more academic perspective. In fact farmers themselves, and especially their representative organisations, are seen as an opposing force for the necessary changes (st.34). The perspective favours a bottom-up approach and it rejects central steering (st.4) and government intervention in general (st.11 & 41). It could be summarised as development for the region, by the region (st.39) and it rejects any international dimensions: international competition on global markets and the management of international production chains is viewed very negatively (st.23 & 24).

This perspective is the most negative in its evaluation of the contribution that technology can make. Technology is part of the problem, not part of the solution (st.30 & 40).

### *Factor D: Entrepreneurs*

*Large-scale industrial development*

The perspective is firmly focused on the international market and the two main elements of this perspective are economies of scale and technology development. The current problem with Dutch agriculture is the place in the production chain of primary producers that forces farmers to compete on price and volume (st.3). A further focus on the primary agrarian production process is inevitable and the means to do this are by increasing the scale of production and further technology intensification (st.22, st.40 & st.25). The added advantage of technology development is that it makes it possible to decrease environmental pressure at the same time (st.30). Regional and small-scale production does not offer any opportunities for global competition (st.5 & st.35). Small market actors cannot survive in the global market and it is therefore pointless for the government to facilitate them in any way (st.41).

Factor D captures a strong entrepreneurial mentality. These farmers are entrepreneurs who produce for the world market and they do not deal directly with consumers. It is therefore the entrepreneur and not the consumer who is leading developments (st.29 & st.43). Retailers are not that important either: they will sell anything if it is financially rewarding (st.16). Social acceptance is not a major issue in this perspective. Consumers have a dim view of the sector but that is not that

important as factor B makes it out to be (st.2). As long as you stay within the laws and rules of the government you should be able to do whatever you like (st.26).

## 4.4 Results

The results of the Q-methodology study show four distinct perspectives on the future of the agrarian sector present within the different innovative projects of TransForum. To answer our question how these perspective differ from general societal discourses on rurality and sustainable development, we will compare these outcomes quantitatively with the rurality discourses and secondly with the more general sustainability discourses (cf. Brown, 1980, pages 246-247; McKeown and Thomas, 1988, pages 43 & 72).

### 4.4.1 Comparison with rurality discourses

In Figure 4.2 the average z-scores on the different discourse statements have been plotted. It shows that some perspectives have more in common with certain discourses than with others. The large size of the error bars is based in part on the fact that the sample size is relatively small for each discourse, however it also indicates that some statements of a discourse are strongly rejected, and this is where the perspectives deviate from the original discourses. *Progressive farmers* score highest on the agri-ruralist discourse, while the entrepreneurial perspective has the highest score on the utilitarian discourse. The hedonist and the utilitarian discourse each have strong proponents and opponents. *Progressive farmers* and *rural development professionals* score significantly negative on the utilitarian discourse, making this discourse the most controversial one. The hedonist discourse is rejected most strongly by the *entrepreneurial* perspective.

Figure 4.2 shows that all four perspectives have at least something in common with the former agri-ruralist discourse. This can be explained by the fact that discourse was once the dominant discourse within the Netherlands. However, this discourse is now under pressure of two emerging discourses, or as we formulated in chapter 3: *"It seems that the agri-ruralist discourse is stuck in the middle, with the possibility of dissolving into the other two over time"*. As such, the four perspectives also show this split. The progressive farmers and the rural development professionals mix elements of the agri-ruralist and hedonist discourse, while the conservative farmers and entrepreneurs take elements from the agri-ruralist discourse and the utilitarian discourse.

The main difference between the *progressive* perspective and the agri-ruralist discourse lies in the importance of social acceptance. Progressive farmers in TransForum have made a turn towards society, while *conservative farmers* turn to the market. *Progressive farmers* and *rural development professionals* both share some of the hedonist discourse. However, unlike the hedonist discourse both disagree that the agricultural sector is in crisis. The main difference between these two is that *rural development professionals* do not see animal welfare as a priority, while for the *progressive farmers* this is linked to their central point of social acceptance. *Entrepreneurs* score highest on the utilitarian discourse. However, they mix this with the agri-ruralist idea of a countryside intended for agricultural production.

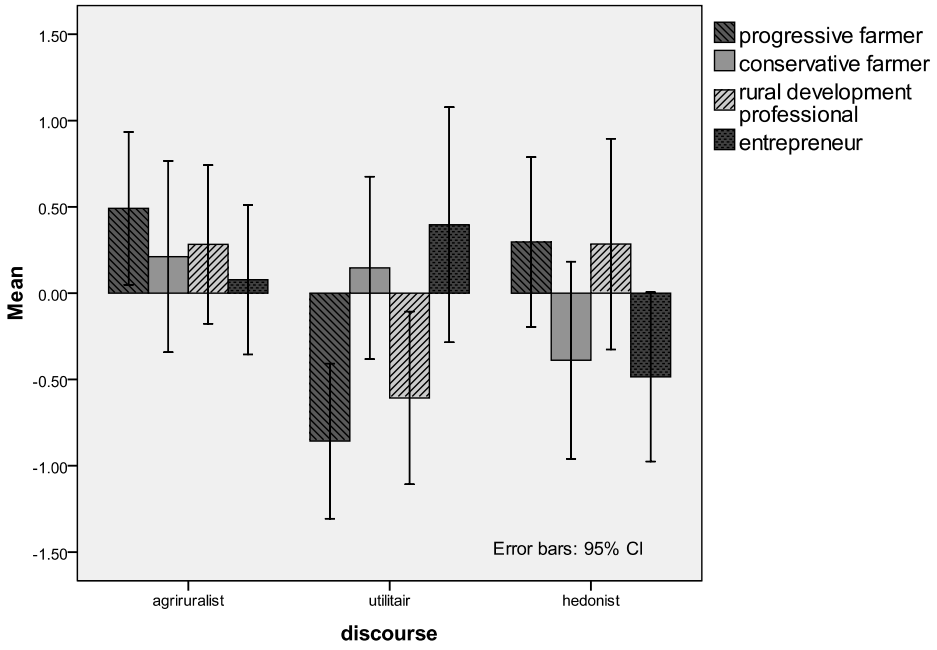



**Figure 4.2.** Average normalised scores on discourse statements

## 4.4.2 Comparison with sustainability discourses

Here, we discuss our results in light of the existing classification of sustainability discourses. When we compared the perspectives with each other, we observed that the role of technology and the role of landscape are the most heavily contested

elements between the four perspectives. For agricultural sustainability these are the two axes that replace Dryzek's two axes of industrialisation and the place of the environment. First of all respondents' view of technology represents the industrialist axis of Dryzek's sustainability classification. Much like the place of the environment, the role of the countryside is also strongly contested. It can be viewed as either separate, as the agrarian production landscape the conservative farmers favour, or it can be viewed within a more integrated approach, combining agricultural production with other functions, like recreation and tourism. Applying these two axes gives four quadrants that discourses on sustainable agriculture can be categorised into.

We have constructed two indicators based on the average scores of each of the four factors on the statements in the Q-set that are related to either technology or the role and functioning of agricultural production and the landscape. The indicator for technology consists of the average score on statements 14, 25, 30 and (-)40 and the indicator for landscape multi-functionality is made up of the average scores on statements 5, 8, 33, 36, 37 and 42. Figure 4.3 shows the place of the four factors on these two axes of agricultural sustainability discourses.

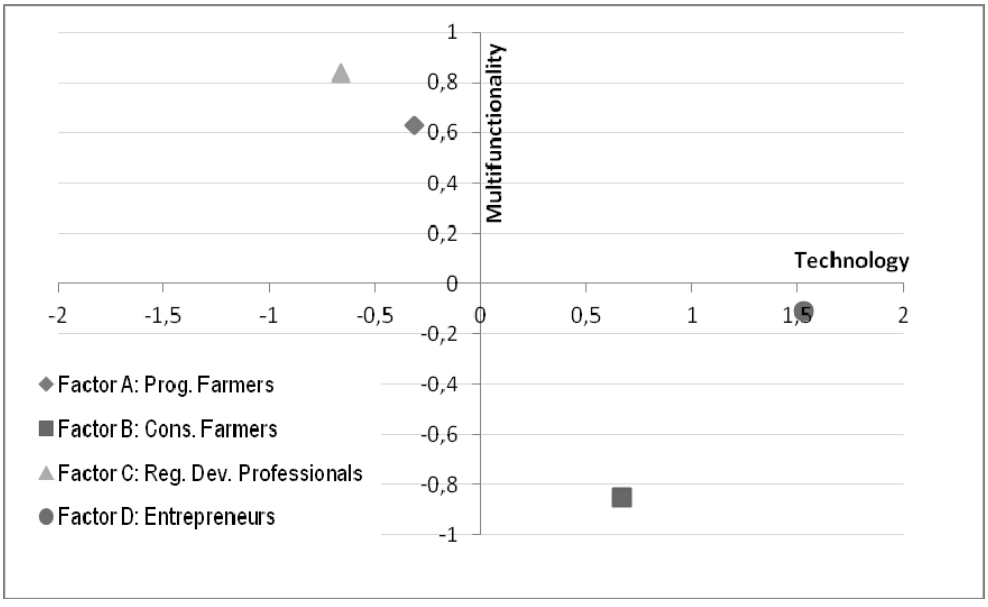



**Figure 4.3.** Average normalised scores on technology statements and multifunctionality

Progressive farmers and rural development professionals (factors A and C) reject technological fixes, while embracing multi-functional agriculture at the same time. These two elements are strongly correlated, and in a sense rural development professionals are more radical than progressive farmers. On the other hand conservative farmers and entrepreneurs (factors B and D) are far more prosaic in their sustainability outlook: there is a belief that the rural landscape belongs to farmers and agricultural production, and that technology is a solution to sustainability problems. However, the important distinction between conservative farmers and entrepreneurs lies especially in this last argument. Both regard technology rather positively, but entrepreneurs do not make a claim to the countryside for production. In this regard, it is also interesting to note that the people in the innovation projects that derive their inspiration from industrial symbiosis and work on integration of product chains in animal husbandry (in order to minimise environmental impacts for example) are part of the group of conservative farmers and not of the entrepreneurs as one might expect (based on the large-scale preferences and general positive attitude towards technology of the entrepreneur). Both groups use the language of economies of scale and productivity increases. However one of the integrated intensive husbandry projects of TransForum received a lot of societal opposition from locals (Termeer et al., 2009). The rural area for agrarian production area reflects a core value of this group and it provides an important explanation for the 'dialogue of the deaf' that has surrounded this project (Hinssen et al., 2010).

## 4.5 Discussion

Based on a quantitative assessment of the results of a Q-sort, we were able to compare the overlap and differences between the 'basket of images' present within innovation projects of TransForum and the more general societal discourses on sustainability and rurality. At this point in time, it is impossible to predict which vision is more likely to result in a major transition in the way agricultural produce and food in the Netherlands is produced. The nature of technological development is such that even small incremental steps might lead to a radical transition eventually, see for instance (Geels, 2005) for a historical case study and Geels and Schot (2007) for an overview of other possible transition pathways. However the execution of a discourse analysis based on Q-methodology is a good method to ensure images that cover the most controversial issues to be included in any innovation portfolio aiming to contribute to transitions.

Based on our empirical findings we were able to come up with an adapted classification of discourses on sustainable agriculture based on the two axes technology versus the place of agricultural production in the countryside.

Remarkable is the absence of an ecological modernisation perspective within the innovation projects of TransForum. The four perspectives we found are split between two 'radical' perspectives that oppose technology as an option and focus on multifunctionality of agriculture and two prosaic sustainability views that are positive about technology but wants to keep the countryside solely for agricultural production. The absence of an ecological modernisation perspective is even more surprising as it is one of the underlying pillars of transition theory (Smith and Kern, 2009). Although it is a well-known disadvantage of Q-methodology, that its findings are difficult to generalise beyond the limits of the studied group, we do think that the absence of an ecological modernisation perspective is not limited to the TransForum programme but that it reflects a more general problem of current rurality discourses: there is a lack of an ecological modernisation perspective of agriculture that is not averse to technological development on the one hand, while it acknowledges the multifunctional nature of the countryside on the other.

We argue that there is a need to fill this missing quadrant of ecological modernisation in the discussions on transitions in the agricultural sector. The concept of 'Metropolitan Agriculture' has the potential to operationalise this missing ecological modernisation perspective and take the edge of some of the debates on agriculture in general. In Metropolitan Agriculture, the demands and advantages of the metropolis (e.g., high population density, infrastructural hubs, technological hotspots, great variety in demands for food and landscape) are used to tailor agricultural activities(Van Latesteijn et al., 2008; Wiskerke, 2009). The activities that might result from this approach can range from care farming to eco-efficient large-scale agroparks. Metropolitan Agriculture can thus be redefined as an ecological modernisation perspective that combines technological development with metropolitan demands of a varied, multifunctional landscape.

As it stands now, both the radical and prosaic perspectives can be limiting the potential to trigger transitions of the agricultural sector. For instance, it seems that the intensive animal husbandry sector could benefit from moving out of the countryside to industrial zones. Our results show that the farmer's strong preference to keep production within the countryside and their own view of the countryside as 'theirs' rather than public opinion is the most limiting factor in realising this. On the other hand, the more radical sustainability perspectives sometimes tend to idealise the past, painting an idyllic picture of the countryside that never existed in reality (Janssen, 2006). In an urbanising world with food scarcity looming, such a technology aversive focus on small scale agriculture is unrealistic and might end up being actually counterproductive.

## 4.6 Conclusions

Using Q-methodology, we distinguished four distinct perspectives on sustainable agricultural and rural development within the innovation project portfolio of TransForum. A quantitative comparison between existing rurality discourses supports claims that the agri-ruralist discourse is slowly splitting up. Our results suggest that a prosaic rurality discourse that contains elements from the utilitarian and agri-ruralist discourse on the one hand, and a more radical rurality discourse that is comprised of hedonistic and agri-ruralist elements on the other hand will be the two dominant discourses of the future.

The role of technology and the function of landscape in agricultural production are the two most contested elements between the four perspectives. This result enabled us to adapt the existing classification of sustainability discourses for application on rurality discourses. Currently a perspective of ecological modernisation is missing, not only within TransForum, but also in rurality discourses in general. The challenge of the future lies in developing such a new perspective that has a multifunctional view of the countryside, without neglecting the possibilities that technological development has to offer the agricultural sector. The concept of Metropolitan Agriculture has this potential.

# Chapter 5

# The Distribution of Roles and Functions for Networking in Agricultural Innovation Systems; a Social Network Analysis

*Agricultural innovation systems are often defined as networks: networks of organisations, enterprises and individuals focused on bringing new products, new processes, and new forms of organisation into economic use. However an agricultural innovation system is seldom assessed as a network and its network functions. In this chapter we present a network perspective on the question how innovations emerge and spread within a the context of an agricultural innovation system. We distinguish between three separate network functions that actors have to perform in order to scale-up their innovation: 1) learning and knowledge creation, 2) lobbying and institutional entrepreneurship and 3) innovation brokerage. We investigate the network functions of an agricultural niche in the Netherlands over a period of 16 years. We look at the distribution of these network functions over the different actors within the network. Results show that the three network functions are concentrated in three small core-groups within the niche that have only a small overlap between them. Results also show that the affiliation of the involved actors to certain organisations influences their capacity to perform certain roles.*

Based on: Frans Hermans, Marian Stuiver, PJ Beers and Kasper Kok: The distribution of roles and functions for networking in agricultural innovation systems; a social network analysis. – Agricultural Systems (under review).

# 5.1 Introduction

Historically, a linear model of knowledge creation and transfer of technology has dominated the thinking about agricultural innovations for a long time. Agricultural knowledge was developed at (agricultural) universities with state-sponsored extension services spreading this new knowledge among the farmers. This approach operated under the assumption that technologies developed by scientists were the optimum of current understanding of agricultural systems and these kinds of studies typically involved questions why adoption of a superior new technology stalled and what factors could enhance the adoption rate further (Leeuwis and Van den Ban, 2004).

Even though the linear transfer of technology model was very successful in increasing agricultural yields and production, criticism grew regarding its limited attention to issues like sustainability and its difficulty in meeting a broader range of development goals that incorporate the multiple functions and roles of farms and agroecosystems better (IAASTD, 2009). As a response a system perspective has become popular that focuses on the structure of an innovation system, how the different actors interact in it and any possible barriers that limit its performance. This innovation systems perspective provides an analytical framework to study technological change in agriculture as a complex process of actions and interactions among a diverse set of actors engaged in generating, exchanging, and using knowledge (Spielman et al., 2008). Instead of a linear perspective, research and development are seen as only a part of a whole range of innovation activities that display feedback mechanisms between the different system components. So far innovation systems have been studied mostly at the three different levels:

- The macro level, focussing on national systems of innovation (Endquist and Lundvall, 1993; Freeman, 1988),
- The sectoral level of which the Agricultural Innovation System is probably the most well-known example (Hall et al., 2003; World Bank, 2006),
- The level of a specific Technological Innovation System (Carlsson and Stankiewicz, 1991; Hekkert et al., 2007).

It is not until recently that the role of micro-level processes within innovation systems have attracted attention in the literature (Alkemade et al., 2011; Klerkx et al., 2010; Markard and Truffer, 2008a). In this chapter we will focus on this micro level and investigate the different roles and functions that actors in a network have to perform as they collaborate together in multi-sectoral innovation projects that not only aim to change agricultural practices, but also aim to change the institutional context that these practices take place in (Moore and Westley, 2011). Even though network studies have been extensively used to model the top-down

linear model of technology transfer, network studies that focus on the development and spread of bottom-up innovations are still relatively rare (Spielman et al., 2008). The central question of this chapter therefore is: What roles and functions do actors, both organisations and individuals, fulfil in the process of upscaling local agricultural knowledge?

We will start the chapter with a discussion on the upscaling of innovations over different levels of an innovation system (section 5.2). Subsequently we will discuss the specific network processes that are important in the co-creation and diffusion of knowledge in agricultural innovation systems (section 5.3). We will use social network analysis (SNA) as an approach that offers a methodological framework to analyse how the patterns of individual interactions influences the knowledge flows throughout the agricultural innovation system to participating partners and further beyond. We will implement this approach by analysing how these different functions have been performed in the network of people and organisations in the case of the Northern Frisian Woodlands (NFW) in the Netherlands. The chapter ends with the conclusions.

## 5.2 The multi-level perspective and emerging technologies in technological innovation systems

The question of how local innovations spread beyond the actors who are directly involved in their development, and how they generate broader system impacts at higher levels has been addressed specifically in the literature on Strategic Niche Management (Rip and Kemp, 1998; Schot and Geels, 2008; Smith, 2006) and Transition Management (Kemp and Rotmans, 2004; Loorbach, 2007; Rotmans et al., 2001b). Transition Management and Strategic Niche Management seek to actively steer technological change in a more sustainable direction, aiming for large-scale system innovations (Kemp et al., 2001). These transition studies have introduced a multi-level perspective (MLP) in which system innovations are seen as a set of nested systems that range from the relatively fast-changing micro level of niches to the stabilising mechanisms of meso-level regimes, and the slow-changing macro level of the socio-technical landscape (Geels, 2002; Geels and Schot, 2007). See section 1.3 in the introduction for a more extended description of these levels.

This multi-level perspective explains the development and growth of an emerging technology through the interactions between the actors within the niche and the socio-technical regime. Actors and organisations can perform different roles that link niche activities to the existing socio-technical regime. Recent contributions have focussed specifically on the overlap between the technological innovation

systems literature and the multi-level perspective (Hekkert et al., 2007; Markard and Truffer, 2008b). The multi-level perspective investigates the structures and processes of an emerging technological innovation system that are conducive to its further deployment and become part of the existing sectoral and national innovation systems.

In this chapter we will take a network perspective on the key processes that have to take place within an innovation system in order for an emerging technology to become part of the existing regime. So far network studies in agriculture have been extensively used to explain the transfer of technology and the adoption of a new technology by farmers as a function of the position a farmer has within the social network. The more persons in the ego-network of a farmer were converted to the new technology, the higher the chance that the farmer in question would also adopt the new practice (Rogers, 2003). However the network perspective has been a relatively new addition to the study of (agricultural) innovation systems (Spielman et al., 2010) and even though the network of connected actors that make up an innovation system is an important variable in many studies on the performance of particular innovation systems (Gildemacher et al., 2009; Klein Woolthuis et al., 2005), its role has remained largely descriptive.

A possible explanation for this lack of attention can be found in the dominance of network research that offers a *structuralist* explanation of the performance of actors based on the specific configuration of the network. In defence of the structuralistic approach, the structure of the network is an important variable that determines the innovative performance of the companies and individuals within the network, but also of the whole network itself (Arora, 2009; Burt, 2005; Meeus et al., 2008; Van der Valk et al., 2011). However, social networks are not static and are as much the product of human interactions as they are responsible for shaping those interactions. Formulated differently, social networks can be used both as the independent and the dependent variable in organisational analyses (Borgatti and Foster, 2003) and by taking an *interactionist* approach on collaboration and learning, the network itself can be regarded as the result of individual behaviour (Gössling et al., 2007). We therefore consider innovation networks to be the result of specific human agency and this raises the question of the mechanisms that play a role in collaborative networks and the roles and functions of the actors that shape the network.

## 5.3 Network functions within innovation systems

The use and application of different functions within innovation systems reflects the variety of levels in use to study these systems. At the level of the individual

there are two overlapping concepts: the innovation champions (Howell and Higgins, 1990; Schon, 1963) and the 'promotors' model (Witte, 1973, 1977). Both these theories focus on the different roles that certain persons have to perform in order to make changes within (business) organisations. Later, these concepts have been extended to account for the roles certain actors have in inter-organisational cooperation. Hauschildt and Kirchmann (2001) extended the original distinction between a 'power promotor' and a 'technological promotor' with a third 'process promotor' for innovations that go beyond a single organisation. Fichter (2009) even added a fourth type, the 'relationship promotor' that is able to form and navigate an innovation network. He further argues that the actors involved in an 'innovation community', all perform a promotor role and form a network of likeminded individuals.

At the level of networks different functions have been described by different authors. Vogelezang et al. (2009) distinguish three different network processes, that they label: knowledge transfer, knowledge circulation and knowledge co-creation. The functions of governance networks have been described by Newig et al. (2010), who distinguish between the three functions of deliberation, knowledge transfer and resilience.

Each of these functions mentioned by the authors above show a certain overlap, although the names of the functions and roles seems to differ somewhat between the authors and the specific level within the innovation system they study, see Table 5.1. In this chapter we will limit our attention to the interaction of individuals and organisations in innovation networks. We thus include three different functions that take place within a collaborative innovation network: knowledge creation, institutional entrepreneurship, and brokerage. We will describe these three functions in more detail in the next sections.

**Table 5.1.** Roles and functions necessary for upscaling innovations

| | **Knowledge creation** | **Institutional entrepreneurship** | **Bridging and Brokerage** |
|---|---|---|---|
| Organisational Innovation (Witte, 1977) | Technological promotor | Power promotor | |
| Inter-organisational innovation (Fichter, 2009; Hauschildt and Kirchmann, 2001) | Technological promotor | Power promotor | Process and Relational promotor |
| Social innovation (Moore and Westley, 2011) | Inventor | Institutional entrepreneur | Broker |
| Governance networks (Newig et al., 2010) | Deliberation | Resilience | Information transfer |
| Learning and innovation networks (Vogelezang et al., 2009) | Knowledge co-creation | | Knowledge transfer and circulation |

## 5.3.1 Knowledge creation in innovation networks

The first function is that of knowledge creation. As a result of the growing criticism on the linear transfer of technology model, new methods for innovation and technology development emerged that focussed more on collaboration and knowledge co-creation with stakeholders. These approaches argue that a combination of actors from different background helps to overcome complex societal problems (Leeuwis and Pyburn, 2002; Van de Kerkhof and Wieczorek, 2005). Innovations thus require the organisation of new networks in which partners from different sectors collaborate and learn together (Van Bueren et al., 2003). These multisectoral collaborations call for different types of organisations to be involved: not only businesses, but also government and non-governmental organisations in processes of social learning and knowledge co-creation between scientists and other stakeholders (Funtowicz and Ravetz, 1993; Nowotny et al., 2003; Regeer, 2009). Innovations are thus co-produced in (a series) of collaborative settings between different participants in processes in which social learning between actors takes place.

In the past, there has been a debate whether organisations can exhibit the same learning functions as individuals (Easterby-Smith et al., 2000). More important for the case at hand is the extent to which individuals in an organisation affect the capabilities of the organisation as a whole. A good soccer team that loses its star player can suddenly change into a mediocre one. The same principle also governs networks: when participants of social learning leave a network, the learning effects in the remaining network can quickly dissipate as was discussed in chapter 2.

### 5.3.2 Institutional entrepreneurship in innovation networks

With the changing role of knowledge creation, more attention also was paid to the societal and organisational changes an innovation requires. A successful innovation therefore is not only about the adoption or rejection of an individual technology, but it is also about changing 'the rules of the game', effectively reforming institutions that define the existing practices (Lounsbury and Crumley, 2007; Roep et al., 2003). The second function within the network that has to be performed is that of the institutional entrepreneur. The term 'institutional entrepreneur' refers to an actor or a group of actors who seek to change institutional arrangements and who leverage resources to create new institutions or transform existing ones (DiMaggio, 1988; Dorada, 2005; Leca et al., 2008). An institutional entrepreneur therefore also works to change the broader context so that the innovation has a widespread appeal and impact. Many innovation systems are fragmented and can be characterised by the co-existence of different coalitions of actors, with different resources at their disposal, pursuing different goals and using different discourses to talk to each other (Sabatier, 1988). As was discussed in chapters 3 and 4, even though many actors agree that the agricultural sector is in need of reform towards more sustainable agriculture, there is no consensus on what this reform might look like. Institutional entrepreneurs therefore perform an important political function within the network, lobbying and translating the results of an innovation in political terms.

### 5.3.3 Innovation brokerage in innovation networks

The third function that actors in an innovation network must perform in order to cross levels is related to their ability to communicate with the different types of organisations in the network. This function is often performed by a special category of actors sometimes referred to as hybrid actors (Elzen et al., 2008), knowledge brokers (Kirkels and Duysters, 2010) or innovation intermediaries (Howells, 2006). This type of actors grease the wheels of the innovation system: they can help in the articulation of knowledge demands through problem diagnosis and foresight exercises; facilitate linkages between possible cooperation partners; and enhance alignment in heterogeneous networks constituted by actors with different frames of reference, norms and values (Klerkx et al., 2009). Especially this last function is important for complex innovations that involve more than one sector. In these cases, innovation brokers are necessary to connect the different types of organisations and to understand and translate the discourses, rules and practices of various types of organisations. These actors are able to understand

specialised knowledge and reframe existing discourses so as to make them understandable to other actors and are able to form a bridge between organisations.

The systemic function of bridging can be performed by different types of actors and at different levels of the innovation system. Individuals can perform this function, but also organisations (Klerkx and Leeuwis, 2009). They can be independent facilitators or researchers that have no stake in the process itself and act as the 'free agents' within the network (Wielinga and Geerling-Eijff, 2009). Here we will define a broker as those actors who are well versed in different types of institutional logic and can facilitate communication between different types of actors, whether they have a stake in the process or not.

### 5.3.4 Distribution of network functions

The question is how these three different functions are distributed over the actors that are active within an innovation network. There are two options here, an actor performs more than one function as he or she plays a different role depending on the specific situation. However, it is also possible that the functions are distributed among different actors within the network, each playing the role that suits him or her best.

In the remainder of this chapter we will use social network analysis to investigate an innovation network to see how these roles are distributed over different actors operating within the network and how this affects the process of upscaling an agricultural innovation. Within transition studies this is sometimes also referred to as the question whether there is enough distributed competence for strategic agency, and whether competent agents are able to connect (Grin, 2010; Grin et al., 2011). Following Fichter (2009), we will assume that all the actors within the network perform at least one of the three network functions.

## 5.4 Materials and methods

### 5.4.1 Case: The environmental cooperatives of the Northern Frisian Woodlands

To investigate the different network functions we have studied the agricultural innovation network of the Northern Frisian Woodlands. The Northern Frisian Woodlands is an area in the Northeast of the Netherlands dominated by dairy farmers. It consists of small-scale, closed landscapes on high sandy soils, alternated by relatively open areas on lower peat-clay soils. The small scale landscapes are

formed by hedges and belts of alder trees surrounding the plots of land, resulting in a unique mosaic of parcels. In the 1990s national regulations were drafted that imposed stringent measures to reduce the environmental impact of agricultural activities. However, these national regulations conflicted with local conditions and threatened the local dairy farms and the landscape. As a response, regional environmental farmer cooperatives were established with the aim to move towards viable and environmentally friendly agro-systems that fit their landscape. The first two of these cooperatives were VEL (Vereniging Eastermars Lansdouwe, *Landscape Association of Eastermar*) and Vanla (Vereniging Agrarisch Natuur en Landschapsbeheer Achtkarspelen, *Agrarian Nature and Landscape Association of Achtkarspelen)*. VEL and Vanla negotiated a contract with the authorities in 1996 when the Minister of agriculture granted the farmers the necessary space to develop and explore their own means to combat the mineral losses on their farms on the understanding that farmers would meet the national environmental aims earlier than elsewhere. Almost from the start, the farmers in the environmental cooperatives adopted a communication strategy that targeted the political level. This resulted in a very strong political interest and subsequent attendance of many political dignitaries during their events. A number of national politicians have visited the area for a field visit, including Dutch crown prince Willem Alexander. This active and successful lobby gave rise to the legislative manoeuvring room to conduct the various field experiments. In these experiments, the farmers worked together with a number of researchers mainly associated with different groups of Wageningen University and Research Centre (Wageningen UR, or WUR for short). They cooperated in a variety of (scientific) research projects that developed new knowledge on the best way to do landscape management and farm management using a system perspective of dairy farming that involved not only the cows and their manure, but also the grassland, the soils and the diets of the cows (Groot et al., 2006; Reijs et al., 2007; Van Apeldoorn et al., 2011).

The innovation processes and the environmental farmer cooperatives VEL and Vanla have been described extensively in terms of innovation and Strategic Niche Management (Stuiver, 2008; Stuiver and Wiskerke, 2004; Wiskerke and Van der Ploeg, 2004), social learning (Eshuis and Stuiver, 2005), governance (Renting and Van der Ploeg, 2001; Wiskerke et al., 2003). This literature clearly demonstrates that the local network has been able to develop new agricultural knowledge that had an impact far beyond its regional borders. It therefore is an ideal case for the purposes of this chapter.

## 5.4.2 Social network analysis

We will analyse the case of the NFW to see how it developed its ideas through cooperation and subsequently disseminated its lessons to other interested partners to gain further political support for its ideas using social network analysis, or SNA for short. Social network analysis has been used as a tool to investigate the properties of networks and the positions of actors in those networks in a semi-quantitative manner (Degenne and Forsé, 1999; Knoke and Yang, 2008; Wasserman and Faust, 1994). Networks can be visualised in a graph that has a set of nodes connected by a set of ties. The nodes can be persons, teams, organisations but also concepts. Ties connect pairs of nodes and can be directed, undirected or valued, depending on the type of relationship. For instance an advice network shows who gives and who receives advice and the ties between the nodes are formed by directed arrows. Similarly ties can also designate a connection by a common membership. This type of relationship is undirected. Finally a tie can also be weighted, signalling the strength of weakness of a tie, or designating the flow of money or resources from one node to another. Depending on the specific relationship under investigation, the same set of actors thus may show different network structures, as depicted in Figure 5.1.

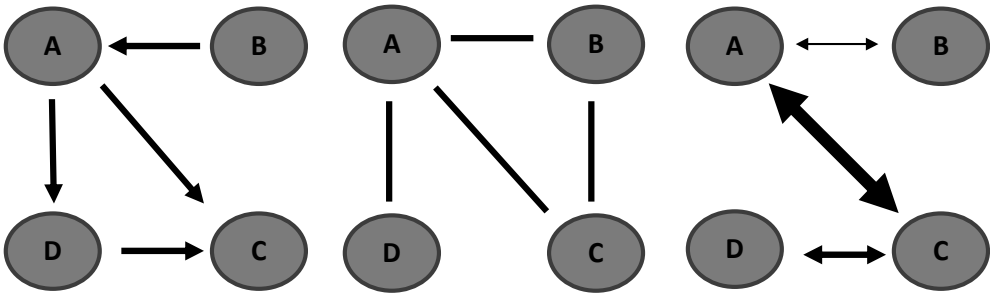



**Figure 5.1.** Three different graphs using directed (left), undirected (middle) and weighed ties (right) to visualise different types of relationship between the same set of nodes (A, B, C & D)

We will use a specific type of social network analysis called two-mode affiliation networks that enables us to study the three functions of knowledge co-creation, entrepreneurship and brokerage. Two-mode affiliation networks look at the network structures that are formed though membership (or participation) of actors in a social event. A two-mode network thus contains two different types of nodes in the same graph called ‘actors’ and ‘events’. The idea behind this type of network analysis is that the characteristics of a certain event can by studied by looking at the types of actors who participated on the one hand, while on the other hand it is

possible to typify an actor by looking at his or her participation in certain types of events (Wasserman and Faust, 1994). Two-mode affiliation networks therefore allow us to study the different functions of the network on two different levels: that of the organisation and that of the individual.

In order to identify the three different functions of knowledge co-creation, institutional entrepreneurship and innovation brokers in the network, we have used three different measures. The learning function can be measured with the *participation rate* that actors have in different multidisciplinary research projects. The more projects they have participated in, the more opportunity they have had to learn, develop new ideas, and to convey their own ideas and visions to the other partners in the project. Knowledge co-creation is a two-way street. Actors can benefit from participating in a cooperative project from the information generated in the project on the one hand, while on the other hand they can exert influence and push the project in a desirable direction.

The function of institutional entrepreneurs is fulfilled by those actors that perform the task of translating the project results to other (political) actors that did not directly participate in a project. These people are important in the process of attracting attention for the results that were obtained in the project, interest possible new partners for cooperation and translate the results politically. To investigate this function we have gathered data on the actors' *participation rates in short term meetings* such as seminars, field visits, openings and other public ceremonies where the actors of the NFW were involved in information dissemination and lobbying beyond the direct project partners.

Finally, the innovation brokers are those actors that link different types of organisations to each other. By definition all actors in a two-mode affiliation network form a bridge between the projects they are involved in and the organisations that they represent. However, if an actor is affiliated with several different types of organisations, he or she potentially functions as an innovation broker in the network.

Figure 5.2 illustrates this with a hypothetical two-mode affiliation network that consists of 22 actors affiliated with 15 different organisations and 3 social events[3]. The Figure shows how an individual actor is connected to different other individuals through his or her affiliation with an organisation or social event. The agency of the individual stems from his capacity to choose the organisations he or she is affiliated with and the social events that he or she attends. On the other hand, the organisations and their internal rules, protocols and regulations, both formal

[3] Mathematically we will treat the events as a type of organisation.

and informal, pose restrictions on the behaviour of an individual. In Figure 5.2 all the actors have participation rate of 1, except for actor 6 who participated in 2 projects. Actors 13 and 22 are the potential brokers as they belong to two different organisations (O and G for actor 13 and G and H for actor 22).

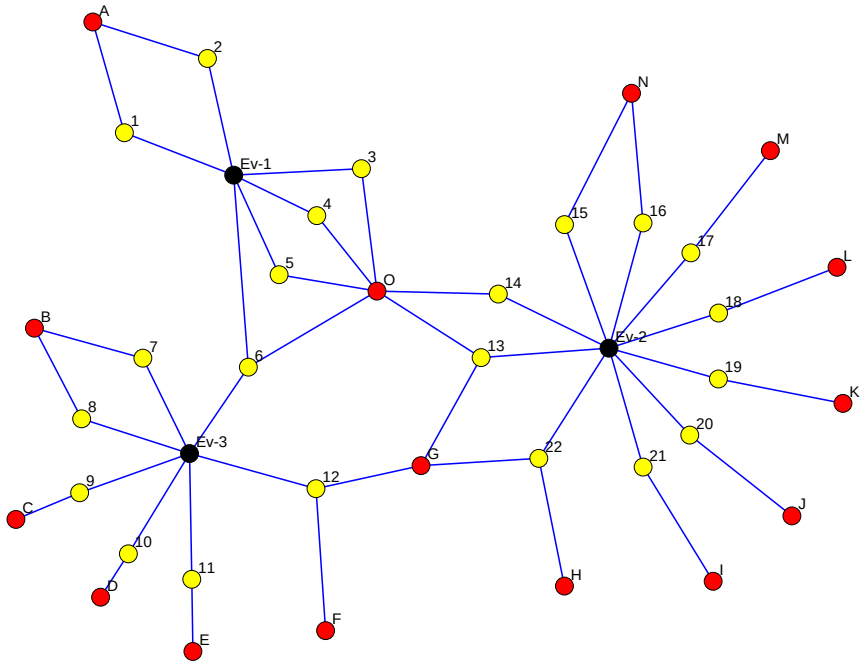



**Figure 5.2.** Hypothetical two-mode affiliation network; yellow nodes (numbered 1 to 22) represent people, red nodes (A through O) are organisations, the black nodes (Ev-1 to Ev-3) represent the social events (projects, meetings, seminars, etc.) that allow the people to exchange ideas

## 5.4.3 Data sources and selection

Data on the projects were collected from the existing scientific sources and descriptions, from the period directly after the foundation of VEL and Vanla in 1992, until the end of 2008. Data include dates of the various projects organised, the people involved in the project and the (multiple) organisations that the actors were representing in a project. The historical accounts these publications provided were enriched with archival information such as project proposals, final reports, and the minutes of various project meetings.

Projects were selected based on the background of participating actors. We limited the selection to only those projects where members of VEL and Vanla participated,

either through actively contributing or more passively by an advisory role, or providing data for further analysis. Departmental working groups consisting of civil servants alone were not incorporated in the data set. Similarly, PhD research projects were not included. Selected projects were checked by two long-time participants in the VEL-Vanla network to improve accuracy and remove inconsistencies. Tables 5.2 gives an overview of the type of projects selected for analysis.

The collected data for the lobbying events were derived from an extended collection of over 220 newspaper clippings detailing the founding of the

**Table 5.2.** Overview of projects

| | **Project Name (in Dutch)** | **Purpose and description** |
|---|---|---|
| 1 | Bedrijfsintern Milieuzorgsysteem | Development of environmental management system at farm level |
| 2 | Onderhoudsplan landschapselementen | Maintenance plan for hedges, belts and alder trees |
| 3 | Beheersovereenkomst De Marren | Nature conservation agreement for 'De Marren' |
| 4 | Samenwerkende milieucooperaties | collaborating environmental cooperatives |
| 5 | Speerpunt Mineralen en ammoniak | insight in mineral and ammonia cycles |
| 6 | Gebiedsvriendelijke mestmachine | Field and soil friendly manure application machine |
| 7 | Mineralenproject 1 | Nutrient Management project 1 |
| 8 | Onderzoeksraad Mineralenprojecten | Research Council Nutrient Management projects |
| 9 | AGRINOVIM | International research project on agricultural novelties |
| 10 | Working group experiential knowledge | Communication and information exchange |
| 11 | Slim experimenteren | 'Smart experimentation' to encourage innovative capacity of farmers |
| 12 | Mineralenproject 2 | Nutrient Management project 2 |
| 13 | Ureumnet | Nutrient administration and software development |
| 14 | Wageningen Atelier | Thinktank on manure application advice |
| 15 | Onderzoek Theo Spruit | Monitoring of environmental performance of farmer Spruit |
| 16 | TransForum Innovative project nr 1 | Feasibility of Regional Contract as a mode of regional governance |
| 17 | Gebiedscontract | Regional Contract for regional development |
| 18 | Effectiviteit Alternatieve Spoor | Effectiveness of the alternative track: low input dairy farming |
| 19 | TransForum scientific project 3MG | Regional monitoring of environmental loads |
| 20 | Onderzoeksraad Noordelijk Friese Wouden | Research council Northern Frisian Woodlands |
| 21 | TransForum Innovative project 2 - Zelfsturing en profit | Regional sustainable development |

VEL-Vanla cooperatives between 1990 and the 2000. These newspaper clippings were further extended with a Lexis-Nexis search between the years 2000-2008 on the topics of "NFW" and "VEL AND Vanla". Table 5.3 gives an overview of the meetings selected for inclusion in the analysis of institutional entrepreneurship. Meetings were specifically selected when they were organised around the transfer of knowledge. A distinction was made between events where information on VEL-Vanla was disseminated (about new plans, presentation of reports and so on) and events where information was gathered by inviting guest speakers (experts) from outside the region to give their opinion or hear their advice for the future of the region. Formal political meetings and gatherings, such as city council meetings or other formal institutionalised policy meetings were not included. It was not possible to record all the persons present during these meetings, as some meetings were attended by over 200 persons. Therefore, only the key-note speakers and

**Table 5.3.** Overview of events

| Date | Event | Type of event |
|---|---|---|
| 19-9-1990 | First meeting of the provincial spatial design commission | Dissemination |
| 3-10-1991 | Discussion evening regional spatial development | Expert |
| 9-12-1991 | Presentation of the 'Maat Houden' study | Dissemination |
| 7-2-1992 | Farmer Union meeting on book 'Maat houden' | Dissemination |
| 17-2-1992 | Discussion evening organised by local Rabo-bank | Expert |
| 1-10-1992 | Discussion evening on the future of dairy farming in the region of the NFW | Expert |
| 9-11-1992 | Public first assembly of Vanla | Dissemination |
| 17-4-1993 | Representatives of national and provincial farmer union visit VEL and Vanla | Dissemination |
| 8-10-1993 | Discussion evening on agrarian landscape management | Expert |
| 26-2-1994 | Presentation vision plan VEL | Dissemination |
| 21-10-1994 | Discussion evening Vanla with the forestry management department | Dissemination |
| 17-2-1995 | Presentation landscape management plan | Dissemination |
| 21-3-1995 | Presentation of five cooperating environmental cooperatives | Dissemination |
| 14-9-1996 | Presentation of field and soil friendly manure application machine | Dissemination |
| 29-3-1997 | Five year anniversary of VEL | Dissemination |
| 13-9-1997 | Field visit of Minister Van Aartsen and crown prince Willem-Alexander | Dissemination |
| 1-2-1999 | Presentation of farm level landscape plans | Dissemination |
| 26-2-1999 | Award ceremony of Municipality of Achtkarspelen | Dissemination |
| 3-7-1999 | Presentation of mineral project | Dissemination |
| 5-4-2000 | Symposium Agrarian Nature Conservation in the province of Friesland | Dissemination |
| 28-7-2002 | 10 year anniversary of VEL and Vanla | Dissemination |
| 22-10-2004 | Workshop Regional Contract | Expert |
| 24-10-2006 | Presentation of the first 'Wouden' certificate | Dissemination |

organisers and the organisations that they were affiliated with during these events were recorded.

## 5.4.4 Analysis procedure

The persons and organisations associated with projects and events mentioned in Table 5.2 and 5.3 were recorded in a database. In order to investigate the brokerage function, the organisations were categorised according to their institutional role. Large organisations (universities and government ministries) were divided into their smaller sub-departments or chair groups. Table 5.4 gives an overview of the categories used in the analysis of the organisations.

**Table 5.4.** Overview of organisational classification

| | |
|---|---|
| 1. Politics | Local political parties |
| | Regional political parties |
| | National political parties |
| 2. Government | Municipalities |
| | Provinces |
| | Provincial and regional headquarters |
| | Water boards |
| | National Ministries |
| 3. Knowledge institutes | University chair groups |
| | Research Institutes |
| | Pioneer and Demonstration Farms |
| | Schools and colleges |
| 4. Green NGOs | Landscape NGOs |
| | Environmental NGOs |
| | (Sustainable ) Energy NGOs |
| 5. Agrarian NGOs | Farmer unions |
| 6. Environmental cooperatives | Environmental cooperatives |
| 7. Business | Consultancy agencies |
| | Banks |
| | Companies |

### 5.4.5 Software

Network analysis and visualisation were done using Pajek 1.26 (Batagelj and Mrvar; De Nooy et al., 2005). Additional analysis was done using the 'R' statistical software programme (version 2.8.0) (R Development Core Team2008) and its 'statnet' package version 2.1 (Handcock et al., 2003).

## 5.5 Results

First we present the results of the three different network functions separately and subsequently discuss them in relation to each other.

### 5.5.1 Knowledge co-creation

Figure 5.3 depicts the network structure for the function knowledge co-creation in the Northern Frisian Woodlands in the period 1992 to 2008. During this period, 21 different projects were started that connected 76 different organisations and 169 different people in total.

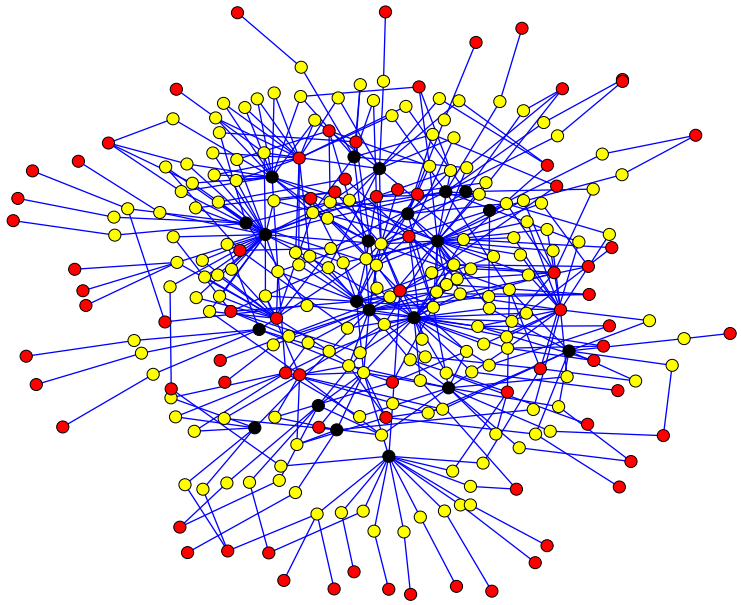


**Figure 5.3**. Two-mode affiliation network of projects (black nodes), people (yellow nodes) and organisations (red nodes) in the NFW between 1990 and 2008

Not all people participated equally in all projects. Table 5.5 shows the distribution of the participation rates over the people in the network. Most persons only participated in 1 specific innovation project and this figure decreases exponentially to a core group of 7 people who participated in more than 5 projects.

**Table 5.5.** Distribution of participation in projects

| **Participation rate** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Number of people** | 122 | 24 | 8 | 8 | 0 | 3 | 3 | 1 | 169 |

Table 5.6 shows the background of this core group of people who were most involved in knowledge co-creation. The table also shows the connectedness of this group to other people in the network (measured as 'degree centrality', the percentage of other actors that an individual is directly connected to through the common membership of a project). People with the same participation rate have different degree centralities. A lower degree centrality means that the projects a person participated in were either smaller or often consisted of the same people, thus reducing his or her reach in the total network.

In this core group of knowledge creators, university scientists are a dominating presence. Their influence in this regard worked two ways, they were active as knowledge creator in the project, but at the same time their influence on the topics to research and the method with which to research them cannot be underestimated. The only 'odd duck' in this table is the former chairman of Vanla, who often functioned as a representative of the environmental cooperatives in many research projects.

**Table 5.6.** Project participation and relative degree of actors

| | **Project Participation rate** | **Relative degree centrality*** |
|---|---|---|
| Project leader Wageningen UR | 8 | 0.601 (1) |
| Chairman Vanla | 7 | 0.518 (2) |
| Researcher Soil and Geology | 7 | 0.470 (3) |
| Professor of Rural Sociology | 7 | 0.357 (12) |
| Project leader LTO-Noord | 6 | 0.464 (4) |
| Professor of Soil and Geology | 6 | 0.435 (5) |
| Professor of Soil Quality and Soil Biology | 6 | 0.429 (6) |

* The number between brackets refers to the rank of this score compared to all other actors in the network.

## 5.5.2 Institutional entrepreneurship

Figure 5.4 shows the two-mode network structure of the events organised between the years 1990 and 2008, during which time 23 events were organised that connected a total of 114 different people and 72 different organisations.

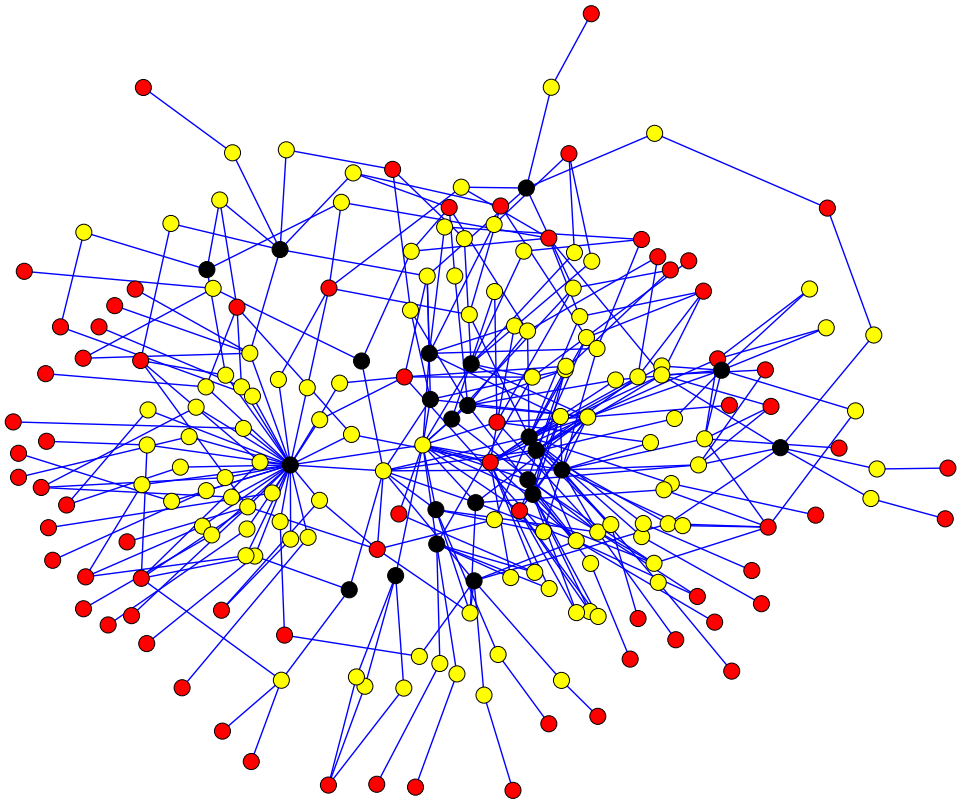


**Figure 5.4.** Two-mode affiliation network of events (blue nodes) persons (yellow nodes) and organisations (red nodes)

To determine the distribution of the institutional entrepreneurs, only the disseminating events were selected (18 events in total, see Table 5.3). Table 5.7 gives an overview of the participation of persons in the these events. The network consists of 77 different actors that at one time or another have been involved in one or more lobbying events, either as organiser or speaker. Most actors (59) were only involved in one single event, in contrast to a small group involved in 7 or more events.

**Table 5.7.** Distribution of participation rate in events

| **Participation rate in events** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Number of people** | 59 | 11 | 3 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 77 |

Table 5.8 shows that the people most involved in institutional entrepreneurship are all closely related to the local and regional network of the environmental cooperatives. They were the ones who had a vested interest and they were the most active lobbyists of their own cause. The professor of Rural Sociology is the only exception. He functioned as the representative of the scientific community in many events, providing the scientific foundation of the knowledge claims of the farmers.

**Table 5.8.** Participation rate in events and relative degree centrality of institutional entrepreneurs

| **Institutional entrepreneur** | **Participation rate in events** | **Relative degree centrality*** |
|---|---|---|
| Chairman Vanla | 11 | 0.618 (2) |
| Board member Vanla | 8 | 0.684 (1) |
| Prof. Rural Sociology | 7 | 0.434 (3) |
| Provincial administrator Friesland | 4 | 0.303 (5) |
| Board member Vanla | 3 | 0.355 (4) |
| Chairman VEL | 3 | 0.263(6) |
| Chairman Provincial Farmers Union (CBTB) | 3 | 0.211 (11) |

* Number between brackets refers to rank compared to all other actors in the network.

## 5.5.3 Innovation brokerage

Innovation brokerage is done by those actors who connect two types of different organisations. Figure 5.5 depicts a simplified network in which the projects and event networks are combined and the different organisations are aggregated according to their institutional role. The thickness of the line connecting two types of organisations is a measure for the amount of people that these organisations share. For instance, the knowledge institutes have many people connecting them to the projects but not that many to the events, while political parties have more ties connecting them to the events, but they barely participate in a project. In Table 5.9 the type of organisations connected to either a project or an event are categorised.

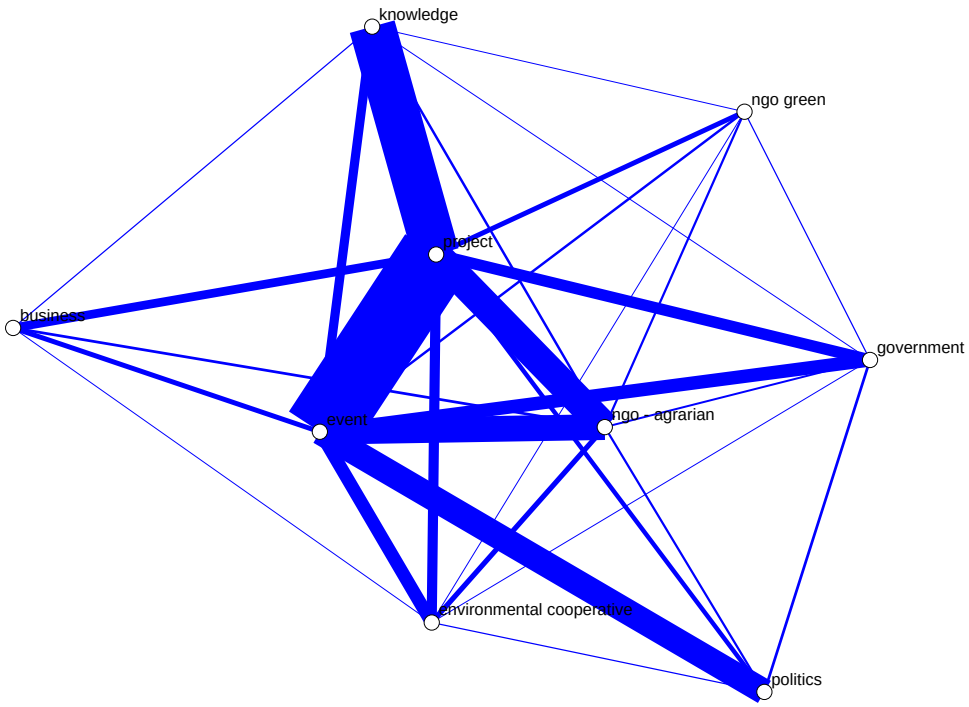



**Figure 5.5.** Aggregated network of projects and events. Line thickness indicates the number of actors that are shared between different types of organisation

**Table 5.9.** Type of organisations connected to projects and events

| Type of organisation | Projects | | Events | |
|---|---|---|---|---|
| Business | 7 | 9.21% | 8 | 11.11% |
| Government | 17 | 22.37% | 14 | 19.44% |
| Politics | 1 | 1.32% | 12 | 16.67% |
| Knowledge | 28 | 36.84% | 15 | 20.83% |
| Ngo – agrarian | 10 | 13.16% | 12 | 16.67% |
| Ngo – green | 7 | 9.21% | 4 | 5.56% |
| Environmental co-operative | 6 | 7.89% | 7 | 9.72% |
| Total | 76 | | 72 | |

**Table 5.10.** Distribution of brokers in network

| **Number of organisation types** | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| **Persons** | 197 | 40 | 6 | 2 |

Table 5.10 shows that, again, there is only a small core group that is able to function as a bridge between different kinds of organisations. Table 5.11 gives an overview of the 8 most successful organisational bridging actors within the NFW network and their connections.

**Table 5.11.** Innovation brokers

| **Innovation brokers** | **Busi-ness** | **Env.-coop.** | **Govern-ment** | **Politics** | **NGO-agrarian** | **NGO-green** | **Know-ledge** | **Number of bridges** | **Degree (rank)** |
|---|---|---|---|---|---|---|---|---|---|
| Project leader LTO-Noord | 0 | 0 | 1 | 0 | 3 | 2 | 1 | 4 | 0.455 (4) |
| Board member NFW and Vanla | 0 | 1 | 1 | 0 | 2 | 1 | 0 | 4 | 0.197 (33) |
| Chairman Vanla | 0 | 1 | 0 | 1 | 3 | 0 | 0 | 3 | 0.607 (1) |
| Project Leader Wageningen UR | 3 | 0 | 0 | 0 | 2 | 0 | 1 | 3 | 0.529 (2) |
| Board member Vanla | 0 | 1 | 0 | 3 | 2 | 0 | 0 | 3 | 0.389 (7) |
| Board member NFW en W&F | 0 | 2 | 0 | 0 | 1 | 1 | 0 | 3 | 0.283 (10) |
| Researcher Wageningen UR-ASG | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 3 | 0.148 (64) |
| Vice chairman Vanla | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 3 | 0.131 (97) |
| Totals | 4 | 6 | 3 | 4 | 15 | 4 | 3 | | |

The table shows that all the bridging actors have been affiliated with an agrarian NGO, indicating the strong position of the farmers unions in linking different organisations within the agricultural innovation system to one another. Some of these double affiliations occurred at the same time, but some also occurred over time: some people first worked for one organisation and subsequently moved to another one. We do consider these people examples of bridging actors, since their previous occupation allows them to translate information from their old organisation to use within their new organisation.

In the list we find only one scientist. Even though both project leaders have had a formal link to the Wageningen University, we do not consider them to be career

scientists. Remarkably, both government and knowledge institutes score the lowest on having brokers associated with them and they form a stark contrast with the agricultural NGOs in the region who were active in linking up with other organisations in the agricultural innovation system, enhancing a person's agency to act as a broker.

### 5.5.4 Distribution of network functions

Regarding the distribution of network functions over different actors, results show that the three network functions of knowledge creation, institutional entrepreneurship and brokerage are concentrated in a small group of core actors. There is some overlap between these groups that perform certain functions, but this overlap is small. Only the former chairman of the Vanla environmental cooperative can be found in all three core groups. He is the only person in this network who can claim the title of 'universal promotor'. There are four other persons from the core groups who have performed two network functions, see the Venn diagram in Figure 5.6.

These findings confirm that the three network functions can be performed by one and the same person, although the capacity to perform two or more different network functions is a relatively rare trait. Most people in the network perform a role that suits them, or better formulated suits the organisation that they are affiliated with.

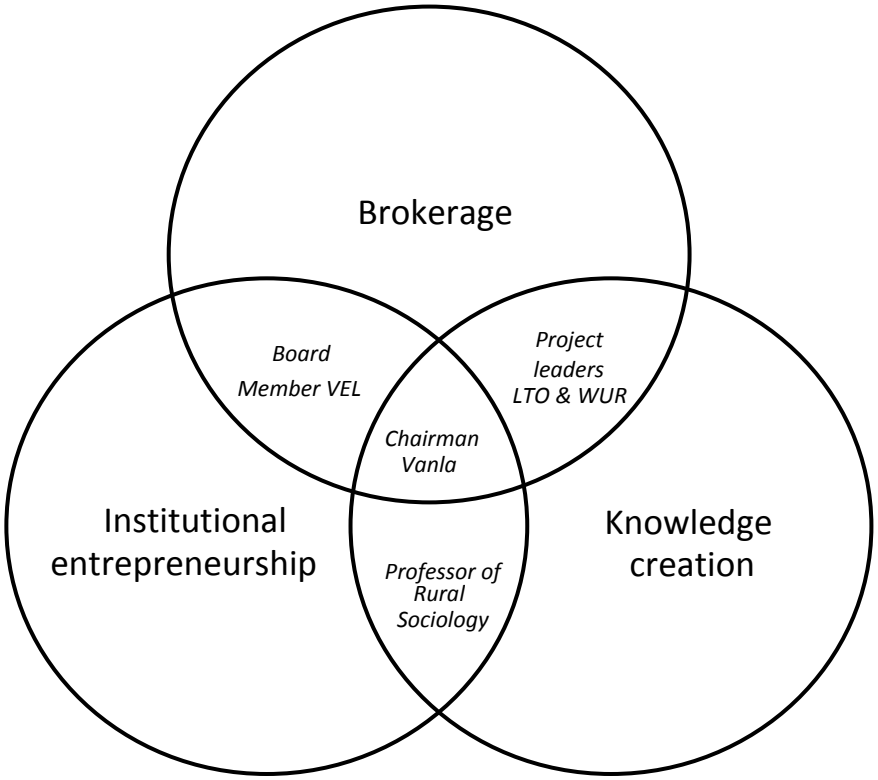



**Figure 5.6.** Venn diagram showing the overlap in network functions

## 5.6 Discussion

In this study we have investigated how social networks are the result of interactions at the individual level. Our analysis covered a period of over 16 years, which is quite a long period. Although this long period guaranteed that all the three functions could be found in the network, it also has the disadvantage that it underestimates the role and function of newer actors in the network. Future research should therefore focus on adding a temporal element in the analysis: what function is needed most at what point in time and is there a shift in different roles, especially for those actors who have performed more than one function? Part of this challenge will be taken up in the next chapter as we will investigate how the network structure develops over time.

The results suggest that the organisations people are affiliated with can enhance or limit their capacity to perform certain functions within the network. Researchers

affiliated with a knowledge institute appeared to be the most influential group in the social learning projects that bring together a wider multidisciplinary group of scientists, farmers and other societal stakeholders. In the case at hand, the scientists played a vital role in the creation of new knowledge, and in testing the knowledge claims made by the farmers.

The political translation of this knowledge appears to have been mainly done by the farmers who also had a direct interest in the new practices. This suggests that the farmers' relation to knowledge was different from the scientists' relation to knowledge. Much more than the scientists, the farmers need for knowledge stems from their need for economic survival. Thus, to an important extent they need knowledge to legitimise their position politically. It may even be the case that it is not the conceptual content of the co-created knowledge that matters, but its meaning for defending a political position.

Innovation brokerage is done by a number of actors, mostly associated with an agricultural farmer union. Affiliations to a knowledge institute or government agency appear not to be conducive to act as an innovation broker. This case shows that it is difficult for either scientists or civil servants to free themselves from the institutional constraints of respectively the knowledge institutes and the various branches of government.

This last result can provide an explanation of what has become known as the 'Dutch Knowledge Paradox'(Carey et al., 2006; OECD, 2005). Dutch Universities rank consistently in the top of European universities in terms of quality and quantity of their research, however this scientific knowledge is not translated into new business opportunities. The limited brokering potential of both researchers and civil servants can be a hindering factor for the successful cooperation between the business sector, government and knowledge institutes.

## 5.7 Conclusions

This chapter argues that social networks do not only form structures that limit or enhance a person's actions, they are also the result of the actions and decisions people make. Social Network Analysis applied in this context offers a new and interesting perspective to investigate the functioning of agricultural innovation system with.

In this chapter we have studied the distributed agency of individual actors to perform three different network functions that are necessary within an emerging technological innovation system: 1) knowledge creation and learning, 2) institutional entrepreneurship and 3) brokering. We have applied SNA on the

extensive network that grew over a period of 16 years in the Northern Frisian Woodlands. We have shown that organisational affiliations are important determinants of a person's capacity to perform certain network functions. As a result the three network functions are concentrated in a small core-group of individuals that only show a small overlap for the three different functions.

# Chapter 6

# Niches and Networks: Explaining Network Evolution through Niche Formation Processes

*This chapter uses the evolutionary perspective of the Strategic Niche Management approach to investigate and explain the network dynamics of a collaborative innovation network. Building upon the theory of socio-technical transitions we link macro-level network dynamics to micro-level niche processes. We constructed a longitudinal two-mode affiliation network of the projects organised in the Northern Frisian Woodlands in the Netherlands, an agricultural niche, over a period of 16 years. The analysis of the network dynamics shows how the structural characteristics of size, composition, connectedness and centralisation of a collaborative network change and how these changes are the result of the social relations between actors at the project level as they choose their partners to cooperate with and enter a process of social learning. We found three distinct phases during which the network composition is more or less stable. Powerful actors are able to shape the composition of the network, either through providing the financial resources or through creating 'legislative space' for the network to grow.*

Based on: Frans Hermans, Dirk van Apeldoorn, Marian Stuiver and Kasper Kok: Niches and Networks: explaining network evolution through niche formation processes. – Research Policy (under review).

## 6.1 Introduction

The increasing complexity of western society has given rise to a special kind of societal problems known under different names as: wicked or messy problems; ill-defined problems; or complex problems (Ackoff, 1974; Van Bueren et al., 2003; Vennix, 1999). These problems are characterised by an intractable mix of cognitive uncertainty, competing discourses and mental frames and colliding conflicts of interest (Hisschemoller and Hoppe, 2001; Roelofs, 2000). In order to solve these societal problems and work on novel technologies with the potential to foster transitions towards a more sustainable development, collaboration between different partners from different sectors: business, government and non-governmental organisations, becomes a prerequisite (Kemp et al., 1998; Loorbach, 2007; Rotmans et al., 2001b; Schot and Geels, 2008).

Studies of socio-technological transitions share an evolutionary perspective of technological development that focuses on the socio-technological niche as the place where new technologies emerge (Schot and Geels, 2007). New and divergent technologies are allowed to survive in these small protected areas where the mainstream pressure from the market or other regulatory forces is lower. The actors in these niches are prepared to accept the initial low performance and higher costs of a new technology and are willing to invest their time and resources to improve it. Niche innovations are therefore often carried and developed by small groups of pioneers: dedicated ‘outsiders’ that are marginal to the existing networks of the socio-technical regime and do not share some of the rules with respect to technical development (Van de Poel, 2000). Historical case studies have shown how many successful innovations started out a in technological niche and how they gradually became more important before they finally took over the existing dominant technology (Geels, 2006; Geels and Schot, 2007).

The lessons from historical case studies have inspired practitioners to purposefully create and manage socio-technical niches that allow for experimentation in order to further promising novelties. Even though the network is identified to be an important element of such a socio-technical niche, its role has remained only qualitatively described in the Strategic Niche Management literature. However, as it is increasingly acknowledged that network structures play an important role in explaining the potential of emerging technologies to become successful innovations and transitions (Caniëls and Romijn, 2008; Spielman et al., 2010; Van der Valk et al., 2011), it also becomes important to study the characteristics of the network as the socio-technological niche evolves over time. This chapter therefore aims to contribute to the study of socio-technological transitions by reframing the developments and changes in a niche in a perspective of network evolution. Studies

on the evolution of social networks show how changes in the macro-level network structure can be explained by micro-level processes (Stokman and Doreian, 1997).

The central questions this chapter poses are: 1) how does the network of a socio-technical niche evolve over time and 2) how can these changes in network structure be explained by the niche formation processes?

Question 1 explores network changes over time. These descriptions of longitudinal networks are still relatively rare. So rare in fact that Knoben et al. (2006) speak of a "longitudinal gap" that exists in the study of collaborative networks In this chapter we use Social Network Analysis (SNA) to map the changes in the network structure of a niche over time using the different collaborative projects that the network partners undertake. Question 2 explores the underlying processes of social learning and partner selection that are responsible for these observed changes.

First, we start with a review on socio-technical niches and collaborative networks that lead us to formulate three propositions on how a niche's network develops over time and what processes are responsible for these changes. To test these three propositions we reconstructed the changes in the network of a socio-technical niche in the agricultural sector in the Netherlands over a period of 16 years. Using Social Network Analysis we investigated the structural properties of this changing network and tested these three propositions on this case. The implications for Strategic Niche Management, the study of transitions in general and the possibilities this approach has for further research are presented in the discussion and conclusions.

## 6.2 Niches and networks

Transition management theory seeks to move current technological pathways into more sustainable trajectories and stresses the development of new knowledge through knowledge co-creation and real-world experimental projects as the means to do it (Raven et al., 2010; Regeer, 2009). Transition theory thus represents a shift from the top-down linear perspectives of socio-technological change towards a systemic perspective that stresses the bottom-up nature of many innovations in which socio-technical niches form the micro-level where radical novelties emerge. In this systemic view, innovations are no longer regarded as 'simple' technological devices that are either adopted or rejected by an individual. Instead innovations are seen as being integrated within a chain of partial innovations together with the new social relationships and organisational arrangements that are developed simultaneously (Hekkert et al., 2007; Nelson and Nelson, 2002).

Building on this innovation systems perspective, we define a socio-technical niche as a small network of organisations, enterprises and individuals that are linked together by a series of collaborative projects that aims to bring new products, new processes and new forms of organisation into (economic) use. As the relationship between the actors in the niche changes over time, so will the structural characteristics of the network. Studying the changes in the properties of the network therefore allows us to derive information on the processes that have been taking place between the different partners within the network and vice versa.

Knowledge co-creation in niches takes place in multi-disciplinary collaborative projects that create an opportunity for people to interact, share their ideas and verify their own mental frameworks in discussion with others. During these processes of social learning, peoples' perceptions change and their individual mental models are aligned into a shared group model enhancing trust between participants along the way (Eshuis and Stuiver, 2005; Leeuwis and Pyburn, 2002; Pahl-Wostl et al., 2007; Pahl-Wostl and Hare, 2004). As already discussed in chapter 2, social learning processes thus result in outputs, the practical plans, policies or technical novelties that were produced, and some intangible outcomes: improved relations between actors and trust. Within sociology the latter kind of relation building has also been referred to as the social capital of a community (Coleman, 1988; Putnam, 1993). In this research tradition, social capital increases with the connectedness of a community. Social learning in niches has the potential to build trust among participants and increase the connectedness of the network.

According to Head (2008), the character of cooperation within networks changes over time with the establishment of trust. In the early stages of the collaborative network, its projects most often can be characterised as forms of *cooperation* in which the work is task-focused, generally short term and participants maintain their organisational identities as they strive to obtain the independent goals and objectives of their organisation. As trust between participants develops, successful co-operations may lead to more complex and ambitious projects being organised that require more *coordination* among the network participant and the installation of a central coordinating organisation. Joint planning or the implementation of an agreed joint working programme for the medium term can be established. The network stabilizes and a central coordinating organisation is created that can take the form of a special platform or a consortium that coordinates interactions in the network and stimulate its further expansion. Since technological niches are not yet ready to function as a market niche, the coordinating role within these kind of networks is often reserved for the government (Raven, 2005).

Finally, the size of a successful niche will change over time from a small network that consist of only the initial pioneers, to a larger network that also involves new actors that see potential in the new technology. When initial expectations of the

innovation are confirmed through positive results of projects and experiments, new actors and organisations are more likely to invest new resources in further developing the technology. This shared expectation provides direction to the projects and experiments done in the niche: promises and practices in a niche develop simultaneously (Stuiver and Wiskerke, 2004). Successful projects thus will make it easier to enrol new actors and expand the network. However, negative results, or results that are below the initial expectations, reduce the faith in the new technology leading to a shrinking network and less resources made available for further testing (Geels and Raven, 2006).

The niches internal process of social learning occurring between the network partners in different projects is therefore expected to influence the network characteristics like cohesion, centralisation and size. Successful projects built trust between participants and this will increase the networks connectedness and make it easier to enrol new actors in the network at the same time. Network growth and the networks connectedness of a niche are therefore expected to be strongly correlated.

*Proposition 1*: *A growing network will become more cohesive as its social capital increases and vice versa: a shrinking network will lead to a less cohesive network as social capital disappears*

Likewise, as social learning promotes the establishment of trust between network partners, more and more complex projects will be undertaken that require more centralisation of the network. We can expect therefore also that network centrality and social capital will be strongly correlated.

*Proposition 2: The network structure of a niche becomes increasingly centralised as social capital builds up between actors and organisations and they move from cooperation to more coordinated forms of collaboration.*

Finally, the choice of partners to collaborate with is an important decision in collaborative networks. This choice is as much influenced by the specific purpose the network pursues as the environment it is immersed in (Geels, 2002; Geels and Schot, 2007; Raven, 2005). As Powell et al. (2005) showed the collaborations within the field of biotechnology broadened over time from commercialisation and valorisation of research, to collaboration in research projects itself that included universities, research institutes and venture capital in varying compositions and with different goals. Cohesive subnetworks were formed that conditioned the choices and opportunities available for collaborations within that field, further reinforcing a trend of seeking diversity in partners to collaborate with.

Complex innovations also require different partners with different resources and knowledge in order to perform different tasks within the network. Loorbach and Rotmans (2006) distinguish four activities that form an iterative cycle within a

niche: (1) the establishment of the initial network for a specific transition theme. (2) The development of a long term guiding vision for sustainable development, (3) the initiation and execution of the experiments, and (4) finally the monitoring and evaluation of transition experiments. Different partners, each with their own expertise or other resources are needed to perform one or several of these activities. Thus we formulate our third and final proposition:

*Proposition 3: Technological niches have distinctly different phases in which the purpose, composition and network properties are related to the specific goals pursued.*

Summarising, these three propositions explain the macro-level changes in the networks size, composition and structural characteristics of connectivity and centralisation by its micro-level process of trust building through social learning on the one hand and partner selection based on complementarity of resources on the other hand. In remainder of this chapter we will describe how we tested these three propositions by constructing the changing network of an agricultural niche in the North of the Netherlands. The long period of time this niche has been running and the continuous involvement of researchers makes this case a very well documented example of Strategic Niche Management (Wiskerke and Van Der Ploeg, 2004).

## 6.3 Method

### 6.3.1 Case: the environmental cooperatives of the Northern Frisian Woodlands

The case of the Northern Frisian Woodlands has already been described in chapter 5. However for this chapter the timeline of events also becomes important and therefore we will describe the different events and their implications for the development of the cooperatives, adding some more detail to the information given in the previous chapter.

After their foundation in 1992, a subsidy of the Ministry of Housing, Spatial Planning and the Environment (*VROM* in Dutch) created the financial room for VEL (Vereniging Eastermars Lansdouwe, *landscape association of Eastermar*) to work out their ideas for landscape management and mineral reduction into a consistent vision. Based on this plan VEL and Vanla (Vereniging Agrarisch Natuur en Landschapsbeheer Achtkarspelen, *Agrarian Nature and Landscape Association of Achtkarspelen)* join forces with three other Dutch environmental cooperatives and successfully lobby the Ministry of Agriculture to let them implement their vision and explore and develop their own means of combating mineral losses on

their farms. A prerequisite set by the Ministry of Agriculture is that the farmers involved in this 'governance experiment' would meet the national environmental aims earlier than they would otherwise be obliged officially by law.

In 1998 VEL and Vanla and three other regional environmental cooperatives join forces in a new regional environmental cooperative, The Northern Frisian Woodlands (NFW). At almost the same time two large research projects commence. The first project is the Nutrient Management Project, a follow up project of the governance experiments of 1996 to evaluate the new approach in a more scientific manner. Additionally an extensive scientific research project (AGRINOVIM) is also approved in this phase by the Netherlands Organisation for Scientific Research (NWO) and the financial resources that accompany this approval, make it possible to involve even more scientists in the region. A scientific council is created that brings representatives of the farmers and the scientific community together and starts to coordinate the research activities in the region. In 2000 a national subsidy program starts that allows for farmers to manage the landscape in exchange for a financial compensation. Over 400 farmers belonging to the NFW enrol in the programme and in 2003 the whole region gets the protected status of National Landscape (Eshuis, 2006).

In 2001, the group of involved scientists in the project split internally over the interpretation of the manure application experiments. The spark that ignited this controversy was the publication of the book '*goede mest stink niet'* (good manure does not smell) (Eshuis et al., 2001) by a group affiliated mainly with the rural sociology department of Wageningen University claiming the success of the early grassland experiments. The second group of scientists, mainly affiliated with the Animal Sciences Department of the same university, contested the claims that were made on statistical grounds. See Stuiver (2008) for an in-depth description of this conflict. In the end a compromise was reached that more research was necessary into the link between grassland quality, manure application and soil quality.

In 2004 a new national subsidy programme is set up with the specific aim to trigger transitions to a more sustainable agricultural sector. The programme, called TransForum, derives its inspiration from transition management and SNM (Veldkamp et al., 2009) and after some lobbying two projects related to the NFW emerge. The first project is a scientific project that places environmental monitoring in a more participatory regional context: instead of monitoring on environmental pollution at the farm level it investigates the possibilities to shift this monitoring to the regional level. The soil scientist who had taken up a more or less neutral position in the earlier conflict came to the forefront to lead this new scientific project. The other project that was started was a practical project aimed at investigating the possibilities and requirements of a regional contract as a new form of rural governance. One of the requirements of TransForum for funding the NFW

was to broaden the regional network and start making work of regional development that also included other sectors, apart from the agricultural dairy sector. In 2005 this regional covenant is signed by the five municipalities, water board, province of Friesland, and the farmers.

Figure 6.1 gives a timeline for the most important events in the history of these two environmental cooperatives. This initial overview already supports some of our propositions in a qualitative manner. Firstly, the conflict between the scientists involved that followed upon the publication of the book "Good manure does not smell", is indicative to a loss of trust between participants. Secondly, the governance structure of the niche did change over the years with more coordination of the network activities in the form of two research councils and the regional contract. With the start of the Regional Contract in 2005, this new governance structure was also formalised. Thirdly, the development of the promises and practices started with landscape management and then further evolved into nutrient management and later broadened to regional development. This required different partners to provide knowledge and experience with each of these practices, resulting in a change in the composition of the network. All in all this case contains all the ingredients necessary to test our propositions regarding network development on. In the next section we will describe our methodology to construct the different network structures over time in some more detail.

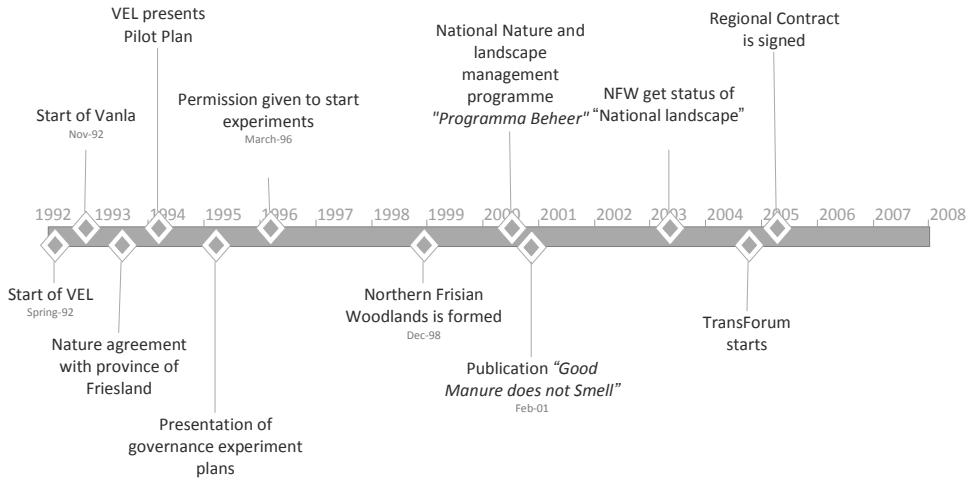



**Figure 6.1.** Timeline for the most important events regarding the Northern Frisian Woodlands

### 6.3.2 Sources of data and data selection

The sources of the data and the method of data collection for the construction of the project networks has already been described in chapter 5, see section 5.4.3 for the details. For this chapter we have limited ourselves to the construction of the project networks with a focus on social learning and knowledge co-creation.

Table 6.1 shows (again) the 21 different projects we identified. For the sake of this chapter we made a distinction between four different types of projects, based on their main purpose: mineral management, landscape management, governance and research. Mineral management projects focussed on the reduction of mineral losses on farms, through the use of 'additives' to the manure, and a systems perspective of dairy farming: feeds, cows, milk, manure and grasslands. The landscape projects focussed on the opportunities landscape management could provide for additional income of farmers. The governance projects focussed on the development of alternatives away from the top-down environmental legislation towards self-governance and a broader agenda of regional development. Research projects were process oriented, either actively coordinating research activities in the region, or evaluating the success of the collaborative projects of farmers and researchers in terms of innovative capacity.

### 6.3.3 Construction of networks over time

Details of the projects, such as the persons and organisations associated with the projects, their starting dates and end dates were recorded in a database. Large organisations (universities and government ministries for instance) were divided into their smaller subdepartments or chair groups. The starting and end dates were rounded to the nearest quarter as sometimes their start point of end point was not exactly clear. The network at any point in time is constructed through aggregation of all the projects that run on a specific point in time, cf. Rosenkopf and Tushman (1998) and Soh and Roberts (2003). In the case of the NFW we identified 29 separate networks that represent a unique configuration of different projects (see Figure 6.2).

Each network consists of a unique combination of projects and the people and their organisations that are affiliated with it. As a new project starts, new organisations and people enter the network and once a project stops they leave again. This way we constructed 29 different *two-mode affiliation networks* to study our case. This class of networks involves two levels of analysis (hence the term 'two mode') often referred to as 'actors' and 'events' (Wasserman and Faust, 1994). The idea behind this form of Social Network Analysis is that persons can be characterised by the

social groups they belong to while at the same time social groups can be characterised by looking at the types of people that make up the composition of the group.

**Table 6.1.** Overview of projects and their focus

| | Name (in Dutch) | Purpose and description | Abbreviation | Type of project |
|---|---|---|---|---|
| 1 | Bedrijfsintern Milieuzorgsysteem | Development of environmental management system at farm level | BIM | minerals |
| 2 | Onderhoudsplan landschapselementen | Maintenance plan for hedges, belts and alder trees | OPL | landscape |
| 3 | Beheersovereenkomst De Marren | Nature conservation agreement for 'De Marren' | Marren | landscape |
| 4 | samenwerkende milieucooperaties | collaborating environmental cooperatives | SMCs | governance |
| 5 | Speerpunt Mineralen en ammoniak | insight in mineral and ammonia cycles | sp.MA | minerals |
| 6 | Gebiedsvriendelijke mestmachine | Field and soil friendly manure application machine | Mst.M | minerals |
| 7 | Mineralenproject 1 | Nutrient Management project 1 | MP.1 | minerals |
| 8 | Onderzoeksraad Mineralenprojecten | Research Council Nutrient Management projects | ozraad | research |
| 9 | AGRINOVIM | International research project on agricultural novelties | AGR.NOV. | research |
| 10 | Working group experiential knowledge | Communication and information exchange | WEK | research |
| 11 | Slim experimenteren | Encourage innovative capacity of farmers | Slim | research |
| 12 | Mineralenproject 2 | Nutrient Management project 2 | MP.2 | minerals |
| 13 | Ureumnet | Nutrient administration and software development | Unet | minerals |
| 14 | Wageningen Atelier | Think tank on manure application advice | Wag.At | research |
| 15 | Onderzoek Theo Spruit | Monitoring of environmental performance of a farmer called Theo Spruit | Spruit | minerals |
| 16 | TransForum IP1-NFW | Feasibility of Regional Contract as a mode of regional governance | TF.IP1 | governance |
| 17 | Gebiedscontract | Regional Contract for regional development | GC | governance |
| 18 | Effectiviteit Alternatieve Spoor | Effectiveness of low input dairy farming | Eff.Alt.Sp. | minerals |
| 19 | TransForum WP 3MG | Regional monitoring of environmental loads | TF.3MG | minerals |
| 20 | Onderzoeksraad NFW | Research council Northern Frisian Woodlands | ozraad.NFW | research |
| 21 | TransForum IP2 - Zelfsturing en profit | Regional sustainable development | TF.IP2 | governance |

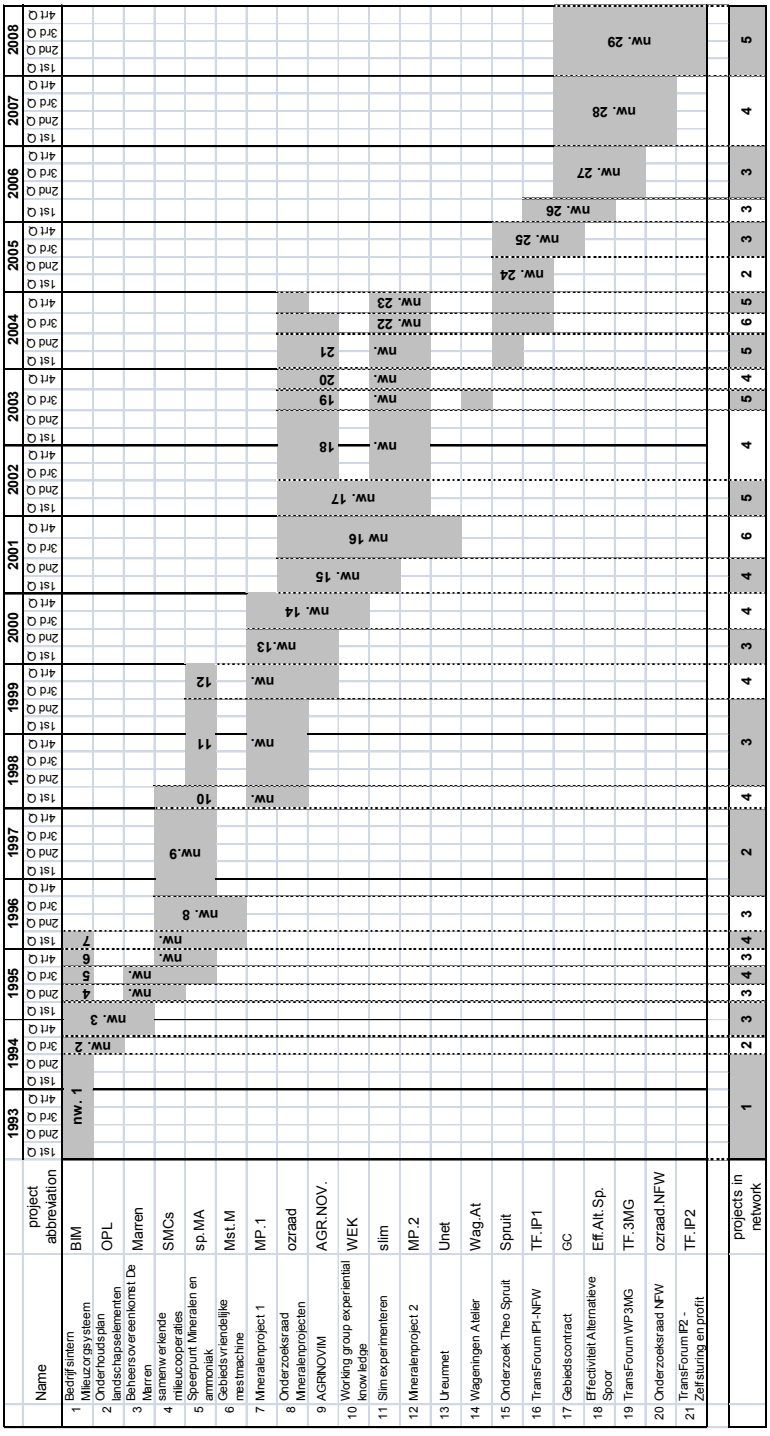



**Figure 6.2.** Construction of networks through projects. The figure shows the different projects and their start and end dates. Each network is comprised of all the projects that are running at the same time. The bottom line of the figure gives the total amount of projects in each network and their duration

### 6.3.4 Analysis procedure

To test our propositions we investigated the 29 networks using three measures that give information on the structure of the network: *density, degree centralisation* and the *composition* of the network. Network density is a measure for the relative amount of links in the network and can therefore be used as a proxy for the amount of social capital in the network: the denser the network, the more cohesive it is and the higher its social capital therefore is. We calculated the average degree of the nodes in the network as a measure for network density: that is the average amount of ties each of the nodes possesses in the network. This measure has the advantage that it is independent of network size (Anderson et al., 1999; Stokman, 2001).

The centralisation of the network was measured using the *degree centralisation* of the network (Freeman, 1979). This is a measure that shows the distribution of the ties within the network. In a highly centralised network, only a few nodes control the communication with all other nodes and it is impossible for the other nodes to reach each other without the help of the central node. The variance in the number of network ties per node is therefore very high in a centralised network: most actors have only one tie connecting them to the central node, while the central node is connected to everybody else and therefore possesses the maximum amount of ties. In less centralised networks the network ties are more equally distributed over the nodes and the variance is lower. This measure has the disadvantage that network size, density and centralisation are correlated, for which we have to control when interpreting the results. We have used the Conditional Uniform Graph Hypothesis Test (Anderson et al., 1999) to investigate this possible interference.

*Network composition* was measured using the organisational diversity within the network. Organisations connected to the projects were categorised according to their institutional role: government, non-governmental, political or commercial. The same categories were used as described previously in chapter 5, see Table 5.4 for the detailed overview.

### 6.3.5 Software

Network properties were analysed using 'R' the statistical software programme (version 2.8.0) (R Development Core Team, 2008) and more specifically its statnet-package (version 2.1) (Handcock et al., 2003). Additional analysis and visualisation and was done using Pajek (version 1.26) (Batagelj and Mrvar; De Nooy et al., 2005) and SoNIA – Social Network Image Animator (Bender-DeMoll and McFarland, 2006).

## 6.4 Results

We constructed 29 different networks based on the combination of collaborative projects running at the same time. Space does not permit a full representation of all 29 networks, however the complete set of networks has been visualised in a short film that shows the growth of the network over time as well as the change in structure. This film can be downloaded as additional information to this chapter[4]. Figure 6.3 depicts networks 1 and 16 as an example of two of these 29 networks. The first network shows the first project that was organised and how it brings ten persons from nine different organisations together. The other network, number 16, shows how six projects run during this period and how these projects are mutually linked through the persons that are member of the same projects.

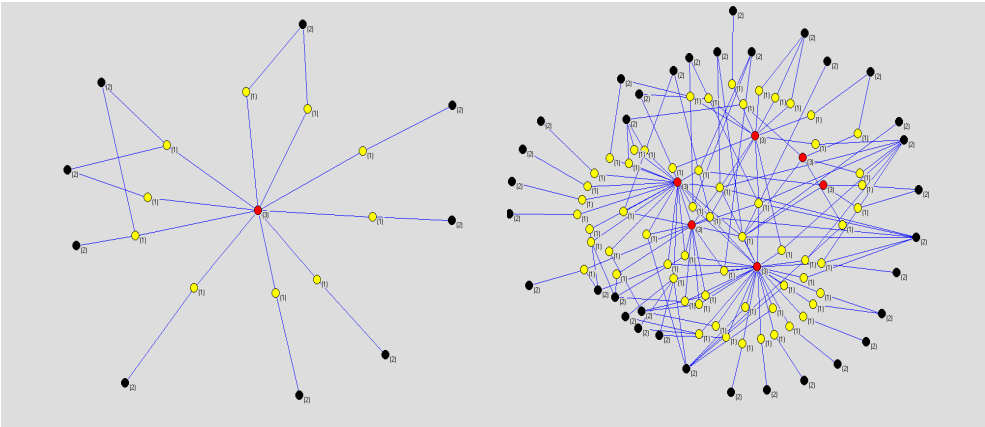


**Figure 6.3.** The VEL/ Vanla project networks 1 and 16 (in January 1993 and October 2001 respectively), black nodes represent organisations, yellow nodes people and the red nodes denote projects

Table 6.2 gives an overview of the various measures for size, average degree per node and the centralisation degrees for each of the 29 networks at different points in time. Figures 6.4, 6.5 and 6.6 illustrate how we have used these data to test our three propositions with.

The proposition that social learning contributes to social capital formation and network growth is strongly supported by our data. Figure 6.4 gives an overview of the development of the total number of organisations and persons in the network, measured as the total amount of nodes in the network, and the social capital of the

[4] This film can also be found on youtube [http://www.youtube.com/watch?v=Z5yP_RkDHtY]

network, measured as the average degree: the average number of ties per node. Network size and social capital, measured as network density, show a significant correlation with a Pearson's product moment correlation of 0.6. This means that as the niche's network grows the network becomes more cohesive at the same time: the average number of bonds between its members increases, making the network more connected. This trend also works the other way around: a declining number of members in the network is related to less social capital. It is impossible to establish the causality of this correlation statistically, however the results show that social capital has been declining somewhat for a certain period after the year 2001 and is slowly growing again after 2005. This coincides with the period the scientific controversy between the researchers of the rural sociology department and animal sciences group played out in the network of the Northern Frisian Woodlands. A loss of trust between network partners would lead to people leaving the network.

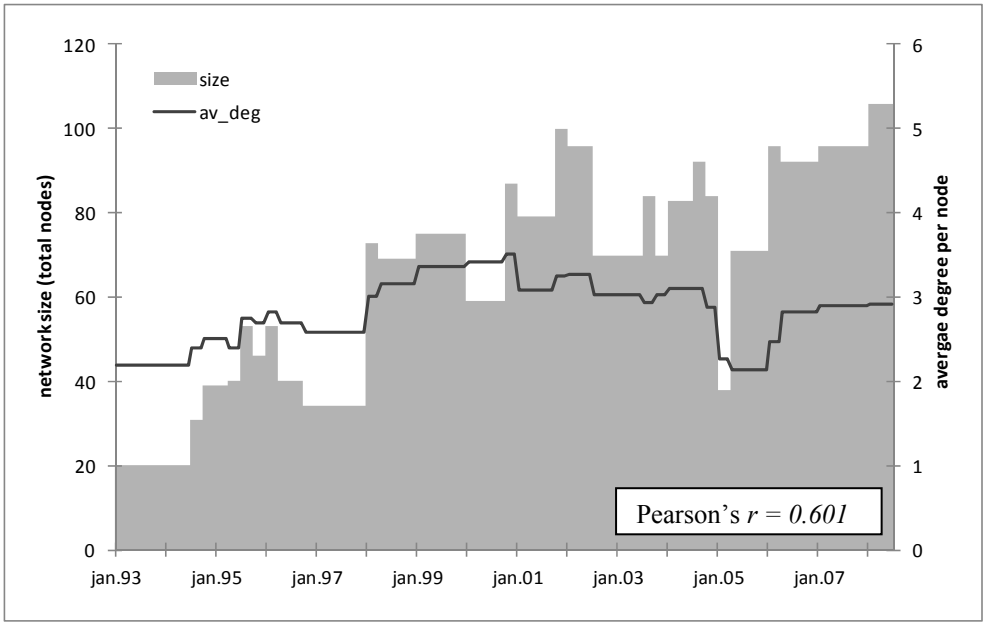



**Figure 6.4.** Total network size and average degree over time, the blue line gives the average degree per node in the network and the red bars give the total amount of nodes, organisations and actors in the network

**Table 6.2.** Overview of network properties per network

| nw. nr. | Start (date) | No. of projects | Persons [n] | Organisations (including projects) [ev] | Total nodes in network | Number of edges [v] | Average degree per node | Centra-lisation |
|---|---|---|---|---|---|---|---|---|
| 1 | 1-1-1993 | 1 | 10 | 10 | 20 | 22 | 2.200 | 0.456* |
| 2 | 1-7-1994 | 2 | 16 | 15 | 31 | 37 | 2.387 | 0.271* |
| 3 | 1-10-1994 | 3 | 22 | 17 | 39 | 49 | 2.513 | 0.208** |
| 4 | 1-4-1995 | 3 | 22 | 18 | 40 | 48 | 2.400 | 0.205** |
| 5 | 1-7-1995 | 4 | 33 | 20 | 53 | 73 | 2.755 | 0.205** |
| 6 | 1-10-1995 | 3 | 28 | 18 | 46 | 62 | 2.696 | 0.239** |
| 7 | 1-1-1996 | 4 | 33 | 20 | 53 | 75 | 2.830 | 0.203** |
| 8 | 1-4-1996 | 3 | 24 | 16 | 40 | 55 | 2.750 | 0.277* |
| 9 | 1-10-1996 | 2 | 19 | 13 | 32 | 40 | 2.500 | 0.361* |
| 10 | 1-1-1998 | 4 | 50 | 23 | 73 | 111 | 3.041 | 0.371* |
| 11 | 1-4-1998 | 3 | 45 | 21 | 66 | 102 | 3.091 | 0.411* |
| 12 | 1-1-1999 | 4 | 48 | 27 | 75 | 126 | 3.360 | 0.356* |
| 13 | 1-1-2000 | 3 | 37 | 22 | 59 | 101 | 3.424 | 0.456* |
| 14 | 1-10-2000 | 4 | 54 | 33 | 87 | 153 | 3.517 | 0.303* |
| 15 | 1-1-2001 | 4 | 46 | 33 | 79 | 123 | 3.114 | 0.340* |
| 16 | 1-10-2001 | 6 | 60 | 40 | 100 | 163 | 3.260 | 0.265* |
| 17 | 1-1-2002 | 5 | 58 | 38 | 96 | 157 | 3.271 | 0.277* |
| 18 | 1-7-2002 | 4 | 42 | 29 | 71 | 107 | 3.014 | 0.279* |
| 19 | 1-7-2003 | 5 | 48 | 36 | 84 | 123 | 2.929 | 0.235* |
| 20 | 1-10-2003 | 4 | 42 | 29 | 71 | 108 | 3.042 | 0.279* |
| 21 | 1-1-2004 | 5 | 50 | 33 | 83 | 129 | 3.108 | 0.236* |
| 22 | 1-7-2004 | 6 | 56 | 36 | 92 | 143 | 3.109 | 0.212* |
| 23 | 1-10-2004 | 5 | 50 | 34 | 84 | 121 | 2.881 | 0.236* |
| 24 | 1-1-2005 | 2 | 20 | 18 | 38 | 43 | 2.263 | 0.278* |
| 25 | 1-4-2005 | 3 | 35 | 36 | 71 | 76 | 2.141 | 0.189* |
| 26 | 1-1-2006 | 3 | 53 | 43 | 96 | 119 | 2.479 | 0.296* |
| 27 | 1-4-2006 | 3 | 54 | 38 | 92 | 130 | 2.826 | 0.305* |
| 28 | 1-1-2007 | 4 | 56 | 40 | 96 | 139 | 2.896 | 0.291* |
| 29 | 1-1-2008 | 5 | 63 | 43 | 106 | 155 | 2.925 | 0.263* |

(*) $p < 0.001$, centralisation degree is significantly higher than the centralisation of 10,000 randomly generated two-mode networks of dimension (n x ev) with v number of edges

(**) $p < 0.005$, centralisation degree is significantly higher than the centralisation of 10,000 randomly generated two-mode networks of dimension (n x ev) with v number of edges

Our second proposition, namely that the network will become more centralised as social capital builds up in the network is not supported by the data. Figure 6.5 shows the average degree and the centralisation of the network over time. The network centralisation builds up before the year 2000 and decreases after that period. With a Pearson's product moment correlation of 0.23 there is only a weak correlation between average degree and centralisation. However, this does not mean no coordination took place. After all, the governance structure of the niche did change over the years with more coordination of the network activities in the form of two research councils and the regional contract that was signed in 2005. However these coordinating activities did not have any effect on the any centralisation of the communication network. Both research councils probably acted more as a portal to the niche but they did not monopolise the communication structures within of the network of the niche. There was still a lot of overlap between the membership of different projects and people were still able to reach each other quite easily as a consequence. However, new (research) projects first had to be approved by the research council, giving the members of the council the control over the influx of new researchers in the network.

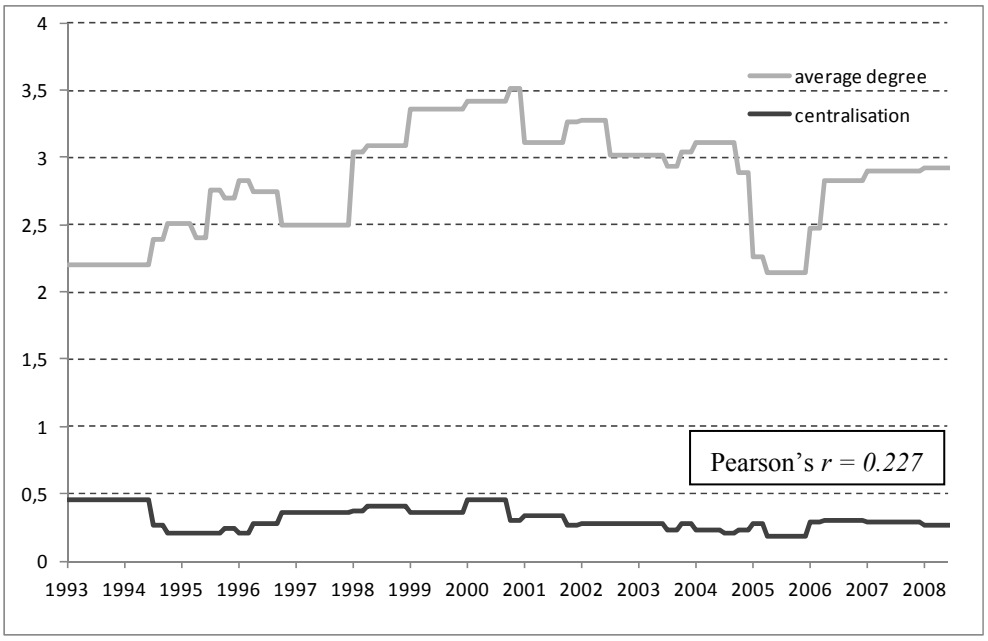



**Figure 6.5.** Centralisation and average degree over time

Finally, our third proposition that the composition of the network shows different phases over time and that these depend on the aims of the network partners is also supported by the data. Figure 6.6 gives an overview of the organisational composition of the network over time. In the beginning different agencies related to the provincial government take up an important part of the network. In January 1998 research groups are added to the network and they make up for more than 50% of the network composition at a certain point. In 2005 the network composition changes again into a more balanced distribution of sectors present: green-NGOs dealing with aspects of environment, and landscape conservation become more involved, as well as local municipalities. Most drastic shifts in the network composition are observed from one phase to the other, however in between these shifts the network composition remains relatively stable.

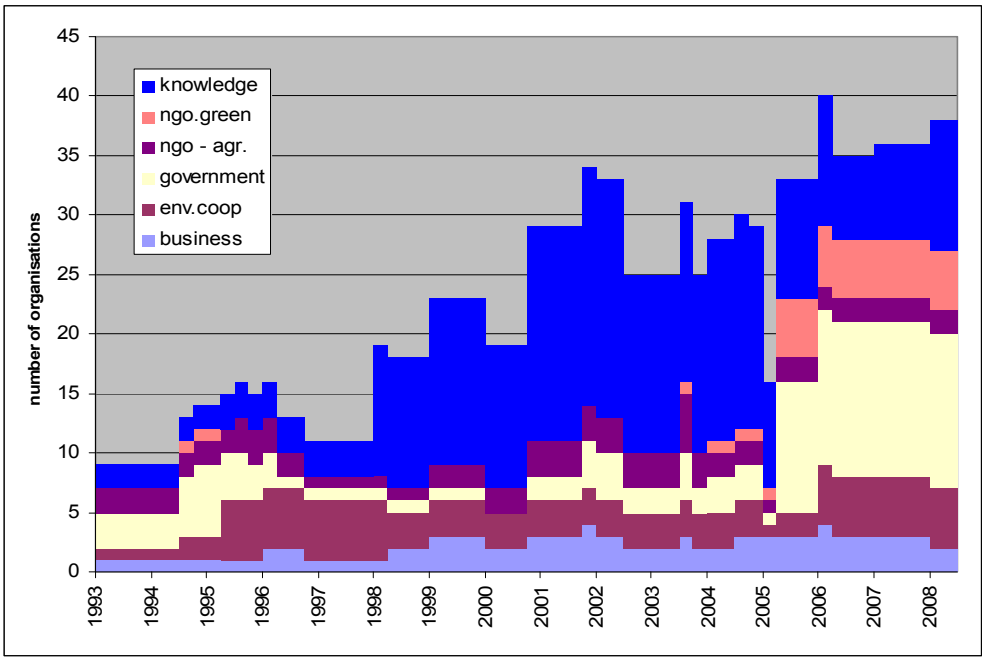



**Figure 6.6.** Network composition number and types of organisations present

We investigated whether the other two network properties (average degree and centralisation) can also be used to classify the three phases. Based on Figure 6.6 we divided the networks in three phases. The first phase (comprised of networks 1 to 9) starts in 1993 and lasted until 1997. The second phase (comprised of networks 10 to 24) started in 1998 with the commencement of a number of research projects and lasted until early 2005. The third phase (networks 25 to 29) started in the

second quarter of 2005 and was still on-going at the point where we stopped the analysis at the end of 2008.

Figure 6.7 shows the boxplots for the network centralisation and the average degree. A one-way between-groups analysis of variance (ANOVA) confirmed that statistically significant difference (at the $p < 0.05$ level) was found in the average degree between the phases, but that the networks centralisation scores of the phases did not. Post-hoc comparison using Bonferroni's test showed that the average network degree of the second phase differs statistically significantly with the other two phases. Phase 1 and phase 3 did not show a statistically significant difference. Our results thus show that based on the purpose and composition of the network, different phases in the niches development can be distinguished that also are reflected in the amount of social capital in each phase.

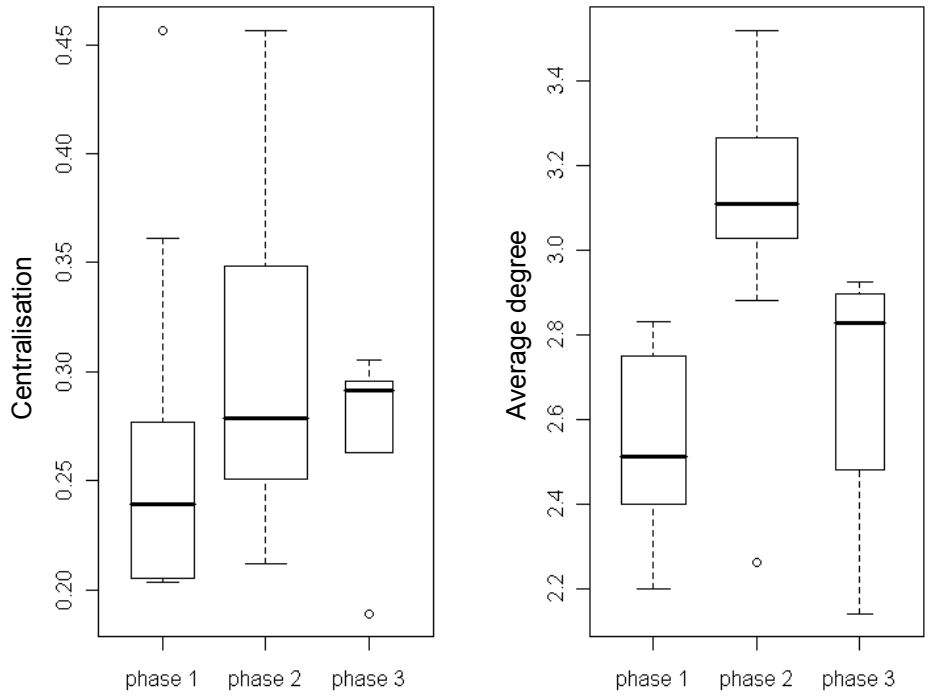



**Figure 6.7.** Boxplots for network centralisation and average degree per phase

A final question that we have not discussed so far is what sparks the shift from one phase to the next? The environmental cooperatives were the result of farmers uniting themselves against the threat of a top-down implementation of national environmental legislation unsuitable to their way of farming in a small scale landscape. This initial phase (phase 0) was characterised by the self-organisation of

farmers in a local network. Funding from the Ministry of Housing, the Environment and Spatial Planning provided with the necessary financial means to work out their alternative vision in a pilot plan that results in a number of projects done in phase 1. Lobbying with the authorities gives the farmers an exemption on the environmental legislation and in the subsequent phase they are allowed to put their alternative manure and landscape management practices to the test during a series of field experiments that are conducted under the supervision of a number of researchers from different departments of Wageningen University. Half way during this phase (phase 2) these researchers developed a major conflict on the statistical interpretation of the experiments. This conflict lingers on in the network leading to a decrease in size and social capital. Unable to prove beyond dispute the positive results of their experiments, the NFW farmers are forced to broaden their initial goals to include new goals of regional sustainable development. In the final phase the network composition changes once again and this time the network composition is strongly influenced by the requirements of TransForum, the organisation that provides subsidies for some of the research projects and a practical experimentation project. All in all the shifts between phases can therefore be attributed to some powerful actors outside the niche that were able to shape the composition of the network, either through providing the financial resources or through creating 'legislative space' for the network to grow.

## 6.5 Discussion and conclusions

In this chapter we have redefined a niche as a network of actors and organisations that collaborate in various different projects over time to test and further develop promising new innovations. Subsequently we have focused on the network evolution of a niche: how the macro-level network properties of size, composition and social capital formation are the expressions of micro-level processes of social learning and partner selection.

Social capital and trust due to processes of social learning lead to a more cohesive network and make it easier to involve new actors and let the network expand. However, there is a limit to social learning. Not all projects lead to consensus and disruptive conflicts between niche partners do the opposite: it leads to the erosion of social capital within the network and a shrinking network. In the case of the NFW the conflict emerged between scientist involved in the network. This led to a stalemate in the niches development that was only resolved by the transition to the next phase of the network. When the niche shifted its focus from mineral management towards the broader goal of regional sustainable development new partners were able to enter and the niche started to grow again.

New network partners are selected based on the particular needs of the network on the one hand and their complementarity of knowledge and resources on the other. A distinction can be made between organisations that are allowed to enter directly into a collaboration and thus become a member of the niches network, and other types of organisations that can still be influential without direct participation.

A limitation of our study is the fact that we have only investigated the formal ties between participants: we have only investigated those ties as they were expressed through the official membership of a multidisciplinary project. This has two disadvantages. First of all weak ties also play an important role in these kinds of networks. The decision who to invite for collaboration in the network in the first place usually start with some informal contacts between possible partners (Ahuja, 2000). However, the choice of our data gathering method based on archival information limits the possibilities of exploring these important mechanisms in this research and further research should focus on the partnering process in niche in more detail. Secondly, supporting organisations such as government institutions and research funds, are not automatically included in our network but their conditions for funding prove to be a very important variable in the explanation of the composition of the network. In this case the network expands and decreases in time along with the finances provided by various governmental subsidies that sustain it. Further research in the evolution of collaborative networks should focus on quantifying this effect, not only in SNM cases where government is very influential, but also in more commercial cases, where the collaborating partners themselves or banks or venture capital provide the funds and resources necessary for the network to expand.

With regard to general transition theory, our study presents an alternative to the prevailing 'multi-level perspective' that is commonly in use when studying socio-technological transitions. This multi-level perspective studies the interactions between the niche and its environment (Geels, 2002, 2004) and more particularly the interaction between the niche and the existing socio-technical regime. Recent contributions have focussed specifically on the nature of the niche-regime interactions within the MLP (Elzen et al., 2008; Smith, 2006; Smith, 2007) and concluded that the analytical distinction between these two levels gets blurred as the niche level and regime level may overlap to a certain extent. Actors and organisations can perform different roles that link niche activities to the existing socio-technical regime. By reframing this interaction between competing niches and between niches and regimes in network terms it becomes possible to study the networks that are formed around different ideas and practices and analyse the different positions organisations and actors have within these network, focussing especially those actors or organisations that bridge different them. More research in this area is necessary but the network evolution perspective we present in this chapter has the potential to allow for more detail in the study of transitions than is

currently possible with the MLP alone. Applying this perspective reframes the development and spread of socio-technical innovations as the result of a process in which many different actors and organisations are linked together by the different projects that they cooperate in, forming an innovation network that changes over time.

The network of the socio-technical niche in the Northern Frisian Woodlands changed over time from a small network, to a larger cohesive network. The changes in network structure can be partly be explained by the niche formation processes. In the early stages trust develops between the participants. Both the number of actors and organisations increased, in concert with social capital. The loss of trust that resulted from the conflict that arose can readily been seen in the network as a sharp decrease in average degree. Successful cooperation however does not lead not to increased centralisation of the network as the increase in social capital could not be linked to an increase in coordination.

The composition of the network depends both on the aims that the networks actors are pursuing when selecting new partners to cooperate with, but also on the influence that powerful actors are able to exert through the conditions they set on the collaborating partners in return for their financial or legislative support. As the aims of the actors involved in the network change, the network composition also changes, allowing the identification of three different phases within the network in which the cohesiveness of the network also remains relatively stable.

# Chapter 7

## Synthesis: Collaborative Innovation Networks for Sustainable Agriculture

# 7.1 Introduction

The Dutch countryside is standing on the threshold of a major transition. Rural development nowadays involves far more than just restructuring agricultural production (Knippenberg et al., 2005; Van der Ploeg et al., 2008). The linear perspective on innovation processes where new knowledge was discovered at universities and subsequently transferred to farmers by means of government sponsored extension services has given way to new types of innovation processes that take a relational perspective on innovation in which knowledge and innovations are co-created together with stakeholders (Leeuwis et al., 2006). These approaches emphasize the importance of experimentation and social learning involving a network of actors from science, businesses, government agencies and NGOs. These types of collaborative innovation networks aim to contribute to so-called transitions to sustainable agriculture, a radical and structural change of the agricultural system as a whole (Loorbach, 2007). This thesis started out with two main aims related to the 'content' of the concept of sustainable agriculture and the 'process' of networking in order to scale up this new knowledge to higher system levels.

The following two aims were discussed in the introduction:

1. To investigate in how far niche visions on sustainable agriculture diverge from the existing societal debates on agriculture.
2. To develop a new perspective on niche development by broadening the application of social network analysis beyond the structural accounts that currently dominate the literature.

Based on these aims, five different research questions were formulated and answered in the subsequent chapters. Each research question was investigated using different cases and different research tools. In this final chapter, the main findings for each of the different questions will be discussed. Subsequently, I will draw on these main findings in a cross-case comparison and reflect what these findings mean to the fulfilment of the two main aims of this thesis. I will discuss these finding in relation to each other and compare them to some of the most recent literature. This chapter ends with some recommendations for further research and for policy makers.

## 7.2 Main findings of the research questions

### 7.2.1 Stakeholder involvement in monitoring regional sustainable development

Research question 1:

*How can the participation of stakeholders be evaluated and how do issues such as context, time and different designs of the participation process influence its results?*

The second chapter provided an illustration of my own hands-on experience with stakeholder participation and social learning. The chapter detailed some of our experiences at Telos, developing and outscaling a participatory monitoring approach for regional sustainable development. These experiences were evaluated using a theoretical framework that distinguishes between the results of participatory monitoring projects in terms of concrete outputs (such as sustainability indicators) and the more intangible social outcomes (such as learning and stakeholder relations).

The comparison of four different cases of participatory monitoring of provincial sustainable development in the Netherlands showed how stakeholders were instrumental in broadening the first monitor developed in Brabant. New sustainability issues selected by the stakeholders reflected the different socio-economic and ecological structural characteristics of their region and helped in removing some of the existing bias in the monitor. The conclusion here is that stakeholders are very able to assess their own region and its strong and weak points. This finding also confirms other publications that rely on stakeholder inputs in scenario development (Kok et al., 2006a; Kok et al., 2006b; Van Vliet, 2011). Since these regional structural characteristics only change slowly over time, the influence of time on stakeholder preferences is shown to be only of minor importance. However, the dissipation of learning effects is shown to be a fundamental challenge for the cyclical nature of participatory monitoring, especially when its goal is shared agenda building. Chapter 2 showed that the most important learning effects are limited to the directly participating groups and this leads to the conclusion that learning processes are limited to people. If these people leave the network, learning effects are taken with them. This main finding is also in line with earlier findings on ‘learning organisations’ that have concluded that individuals are the only ones who learn and that organisations can only facilitate the learning process or act as storage of knowledge (Easterby-Smith et al., 2000). Current attempts to redefine social learning as a collective process that surpasses individual learning (Reed et al., 2010) underestimate this problem. It may very well

be possible that in a stable group of people there is an emerging effect for the outputs that surpasses individual learning. However the results of chapter 2 cast doubt whether this effect will hold for long in a collaborative innovation network that operates in a dynamic environment with people continuously entering and leaving the network.

*Main findings:*

- Top-down political support for bottom-up initiatives is a sine-qua-non for stakeholder participation.
- Stakeholders can be trusted to correctly assess the characteristics of their own region, sometimes even better than researchers.
- The influence of time on stakeholder preferences is only of minor importance in determining the relevant sustainability issues.
- In the design of participatory processes, more attention should be devoted to providing stakeholders with the opportunity to comment on an 'intermediate' product
- Social learning effects are limited to the directly participating groups and dissipate quickly in fast changing networks.

### 7.2.2 Discourses on sustainable agriculture in The Netherlands

Research question 2:

*What are the current Dutch perspectives on sustainable agriculture?*

- *How are they related to existing perspectives on sustainable development and rurality?*

The second research question was concerned with the current rurality discourses in the Netherlands and how they have incorporated the issue of sustainability. Qualitative analysis of interviews indicated that the three different discourses of rurality previously identified by Jaap Frouws (1998) are alive and kicking. The traditional *agri-ruralist discourse* of the farmers, the neo-liberal *utilitarian discourse* and the *hedonist discourse* of the urban population have each incorporated their own version of agricultural sustainability that is a natural continuation of the already existing rurality discourse.

The redefinition of Dutch agriculture and the Dutch countryside is therefore still contested and sustainable development has not functioned as an unifying concept to help different parties overcome their differences and work on win-win solutions. The hedonist and utilitarian discourses in particular aspire to sustainable agriculture

on different scales and with opposing arguments with the agri-ruralist discourse with its traditional focus on the family farm being stuck in the middle. Through globalisation and the integration of the European agricultural markets the utilitarian discourse is slowly replacing the family farm model on the one hand, leading to large, intensive farms searching for space in the countryside. On the other hand we see a discourse coalition consisting of members of the urban population, landscape conservationist and animal welfare activists steadily growing on the regional level. They form the 'outsiders' that have entered the countryside, breaking the old coalition open. Rural development is no longer the exclusive domain of farmers. They are one of the partners in the hedonist discourse but they are often not the most important one.

*Main findings:*

- The three discourses of argi-ruralism, utilitarianism and hedonism are still an adequate representation of the three main discourses on agriculture and rural development in The Netherlands.
- Each of these three discourses has incorporated the concept of sustainable development differently, but in a manner that is a natural continuation of the original discourse.

### 7.2.3 Discourses on sustainable agriculture within the TransForum programme

Research question 3:

*What different vision of sustainable agriculture can be discerned in different innovation projects aiming for a transition?*

- *What does this mean for the innovation potential of the Dutch agricultural sector?*

The three rurality discourses were used as a basis to investigate the visions of sustainable agriculture within the TransForum programme. TransForum organised a number of practical innovation projects that were intended to trigger transitons towards sustainable agriculture within the Netherlands. Their portfolio covered a wide range of topics in which participants could try out new ideas, learn from them and work together to overcome obstacles hindering system innovation. The overall innovation strategy of TransForum promoted a bottom-up vision of innovation: the whole programme involved a combination of 'learning-by-doing' and 'doing-be-learning'.

Using Q-methodology the individual perspectives on agricultural innovation were systematically elicited and four different perspectives were identified belonging to four different groups that we have labelled: *entrepreneurs, conservative farmers, progressive farmers* and *rural development professionals.* Results show that the use of technology and the agricultural production function of rural landscapes are among the two most contested elements between these four perspectives. The portfolio of TransForum therefore reflects the same problem that current Dutch agriculture has: the main perspectives are in complete opposition to each other. They are either anti-technological focusing on a multi-functional use of the countryside, or technophile with a strong sense of entitlement of agrarian production in the countryside. Both these extremes are limiting the possibilities for innovative projects to become successful.

In order to overcome the current stalemate and thus improve the innovation potential, we looked into the concept of Metropolitan Agriculture. Metropolitan Agriculture can be defined as a form of ecological modernisation that looks favourable upon technological development and at the same time sees the need for a multifunctional use of the countryside, one that also involves other non-agrarian actors. This definition of Metropolitan Agriculture echoes other authors that argue for more attention to urban food strategies that aim to integrate different policy domains that are (in)directly linked to food (Wiskerke, 2009). Likewise, Horlings and Marsden (2011) argue for a 'broad definition' of ecological modernisation in the agricultural sector, one that also includes social, cultural, spatial and political aspects.

*Main findings:*

- Q-methodology is a good method to ensure that a broad set of discourses, covering the most controversial issues, are included in any innovation portfolio aiming for transitions.
- Perspectives present within the innovation projects combined elements of the three discourses, but were not a radical break from them. These findings give further evidence that the agri-ruralist discourse is slowly dissolving.
- Perspectives differ along two main axes: the use of technology and the agricultural production function of rural landscapes.
- The ecological modernisation perspective on agriculture favours technological development as a solution but at the same time understands the importance of a multifunctional use of the countryside. This ecological modernisation perspective is currently absent in Dutch agriculture.

### 7.2.4 Network functions necessary to scale local agricultural innovation up

Research question 4:

*What role and functions do different actors and organisations have in the upscaling and outscaling of niche innovations?*

- *How are different network functions distributed within an agricultural niche?*

The second aim of this thesis focussed on the social side of innovation. Given the intrinsically relational nature of social learning and multidisciplinary collaboration, a niche can also be framed as a network: places where a broad range of participants generate new knowledge and subsequently distribute this over the participating partners and further beyond. With transitions aiming to be more than a technological fix, a change in the institutional environment is necessary as well. Within transition studies this is sometimes also referred to as the question whether there is enough distributed competence for strategic agency, and whether competent agents are able to connect (Grin, 2010; Grin et al., 2011). In chapter 5 a network perspective was presented focussing on this question. Based on a literature review of the roles and functions that need to be performed in organisational, inter-organisational and social innovation networks, three separate network functions were identified: learning and knowledge creation, secondly institutional entrepreneurship and lobbying, and thirdly innovation brokerage. We have argued that actors in an innovation network have to perform all of these three functions in order to scale-up their innovation.

The results of the network analysis done in chapter 5 showed that these three network functions are concentrated in three small core-groups of individuals that only show a small overlap. Results also showed that the organisations people are affiliated with, can greatly enhance or limit their capacity to perform certain roles. Researchers affiliated with a knowledge institute are the most influential in the social learning projects that bring together a wider multidisciplinary group of scientists, farmers and other societal stakeholders. Under research question 1 we have already discussed the difference between organisations and individuals when it comes to learning and the results of chapter 5 not only emphasize this, but also show it's applicability to the other two network functions. In the case of the NFW, the political translation of new knowledge was done by the farmers who also have a direct interest in the practice under study and innovation brokerage was done by a number of actors, mostly associated with an agricultural farmer union. At the same time affiliations to a knowledge institute or government agency were shown to be not very conducive for the performance of the bridging role between different types

of organisations. It seems that it is difficult for both scientists and civil servants to free themselves from the institutional constraints of respectively the knowledge institutes or the various branches of government. The limited bridging potential of two of the three corners of the Golden Triangle of Innovation (collaboration between knowledge institutes, government agencies and business) offers an explanation of what has become known as the 'Dutch Knowledge Paradox' (OECD, 2005): Dutch Universities rank consistently in the top of European universities in terms of quality and quantity of their research. However, this scientific knowledge is not translated into new business opportunities.

*Main findings:*

- For the upscaling of local innovations, three network functions are important: knowledge creation, institutional entrepreneurship and brokerage.
- Two-mode affiliation networks are a good tool to investigate the distribution of these functions in an innovation network.
- Results show that the functions are concentrated in three small core-groups of actors that have only a small overlap between them.
- The organisation, or organisations an individual is affiliated with, strongly influences his or her capacity to perform certain network functions.

### 7.2.5 Network evolution of a socio-technical niche

Research question 5:

*How does the network of a niche evolve over time?*

- *How can these changes in network structure be explained by the niche internal processes?*

Chapter 6 redefined as niche as a network of actors and organisations that collaborate in various different projects over time to test and further develop promising new innovations. Subsequently the component of time was added to the mix as the network evolution of a niche was investigated. Network properties at the macro level (like size, composition and social capital) were shown to be the expressions of micro-level processes of social learning and trust building.

When people and organisations collaborate together, improved stakeholder relations and the development of trust development form one part of the intangible outcomes of social learning (see also chapter 2). Successful collaborations make a niche grow over time both in the amount of nodes (people and organisations in the network) as in its social capital: the average amount of ties binding these people

and organisations together. This process works both ways: the loss of trust that results from conflicts can readily been seen in the network as a decrease in average degree of the nodes in the network and in network size. Successful cooperation however does not lead not to increased coordination of the network as the increase in social capital could not be linked to an increase in network centralisation. The most important force that shapes the composition of the network comes from some powerful actors that are able to exert their influence through the conditions they set on the collaborating partners in return for their financial support (TransForum) or legislative support (the Ministry of Agriculture).

As the aims of the actors involved in the network change, the network composition also changes. This allows for the identification of two iterative phases within the network in which the cohesiveness of the network also remained relatively stable: first *agenda setting and vision creation* and secondly *testing and experimentation*. In the third phase *an adaptation of the initial vision* was made and new targets were formulated together with a new group of actors in the network.

*Main findings:*

- Social learning and partner selection explain evolving network structures.
- Successful cooperation leads to an expanding network with more social capital and vice versa.
- Based on network composition, cohesiveness and size three stable phases were identified.
- Powerful actors are able to shape the composition of the network.

## 7.3 Implications of main findings

In this thesis some of the social processes related to stakeholder participation, multisectoral collaborations and social learning were explored. In this section the main findings of the different chapters in this thesis will synthesised. By making a cross-case comparison, the main findings will be related to each other and some overarching implications will be formulated for the different fields that this thesis has brought together.

### 7.3.1 Discourses of sustainable agriculture and the implications for transition studies

In the introduction the debate on the role of guiding visions in the process of transitions was noted. The transition management literature emphasises the importance of building a shared vision within the niche. Some authors have questioned whether the actors in a niche can be trusted to develop a new comprehensive sustainability vision, or whether these vision have more to do with the existing established interests of the socio-technical regime (Berkhout et al., 2004) . Others downplay the importance of vision creation, noting that many vision exercises never have an adequate follow-up and that these exercises have become 'rituals' to show the good intentions of participants as a form of public relations (Schot and Geels, 2008). The results of the cases shows that actually both sides of this debate are wrong, or to put a more positive spin on it: both sides are partly right depending on the specific case under investigation.

The TransForum case that was investigated in chapter 4 shows that the critics have a point in the sense that the innovation perspectives within TransForum were closely linked to existing rurality discourses and the existing split between a more utilitarian discourse and a more hedonist discourse was reproduced in the innovation projects. This case shows that perspectives at the project level are embedded to such an extent in the existing agricultural system, that their general ideas and discourses are not completely new: they are only a different form of existing discourses. The TransForum programme therefore did not result in radical niche perspectives as one would expect. Two possible explanations for this finding can be given. The most far-reaching explanation is that it is paradoxical to "strategically manage" a "radical niche". From a radical perspective, a multi-actor collaboration might be seen as overly compromising, especially if there is one specific concern that they view as paramount to their cause. If radical niches oppose the underlying assumptions of transition management, then multi-sectoral collaborations cannot be expected to foster radically new perspectives, but only incrementally different perspectives. An alternative, more practical, explanation resides in the funding criteria for TransForum's innovation projects. TransForum operated on the basis of ' matched funding' in which the project partners themselves would be asked to provide (about 50% in TransForum's case) of the project funds themselves. Matched funding is a principle used in many Dutch innovation programmes, and TransForum was no exception. It is popular because it ensures the commitment of participants, as they are required to shows their willingness to share some of the risks themselves and invest in their own ideas. Unfortunately, it also favours vested interests and existing networks represented at

the regime level, since it is precisely these actors that are able to raise the necessary capital to compete for this kind of subsidy.

However, the case of the Northern Frisian Woodlands discussed in chapters 5 and 6 gives a more dynamic perspective of the role visions can play in niches. From this case, it can be concluded that the proponents also have a point. This case showed the importance of guiding visions, in this case visions on the farmers as landscape manager and the idea of on-farm 'nutrient management'. Farmers' shared vision on the local landscape and its need for conservation functioned as catalyst for the self-organisation of the farmers in the early phases of the cooperatives. The idea that landscape conservation could be an alternative source of income for farmers was, at the time at least, perceived as a radical break from the prevailing discourses in farmer cycles. The idea of landscape conservation was quickly dismissed because 'farmers are no foresters' and there was no market for 'milk from lumberjacks'(Van der Ploeg et al., 2007). The cooperatives were able to completely turn this view around and nowadays some politicians in the current government seem to think that farmers are the only people who should be involved in landscape conservationism. Guiding visions therefore played an important role in the process of institutional entrepreneurship, attracting political attention and new project partners.

In the end, both proponents and critics are wrong in the sense that they both overemphasise the distinction between niches and socio-technical regimes. Discourse elements are interweaved to such an extent in both niches and regimes, that it becomes impossible to separate them clearly. The results of chapter 3 are a very good example of this process: discourses on sustainable agriculture are more about agriculture and rurality than about sustainable development. Issues of sustainable development became weaved into the existing rurality discourses in a process of 'interanimation' (Bakhtin, 1981; Mische and Pattison, 2000). This thesis shows that innovations for sustainable development need institutional entrepreneurship and this is a political process where the guiding visions are necessarily embedded in broader existing discourses. When a niche wants to 'sell' a new idea, it has to place it in a familiar framework using existing discourse elements, however this does not mean that they are mere reproductions of the existing status quo.

### 7.3.2 Network dynamics: Implications for the study of collaborative networks

The second part of this thesis was concerned with introducing a network perspective on the study of niches. Network analysis have been used previously to

model the linear transfer of technology mechanism, but so far little work has been done on bottom-up innovations that require the incorporation of political lobbying activities in the network. To do this, it was necessary to broaden the scope of social network analysis beyond the structural explanations it routinely offers and recognise that networks are as much the result of human behaviour. This thesis has presented a bottom-up perspective on network formation, by investigating how network structures change over time and how these changes are the result of actors entering and leaving the network. Studying networks over time has not been done that much in the social sciences (Knoben et al., 2006). One of the reasons for this gap is undoubtedly the large data sets necessary to investigate one network at one time, let alone the data necessary to map the multiple networks at different times.

This thesis has presented a simple, yet elegant, method to map the various network configurations over time by focussing on the flow of (multidisciplinary) innovation projects that are undertaken by a changing group of people. These projects form the glue of the network and are the places were actors interact, discuss and shape their ideas. As projects starts or end, the network configuration changes with it. The resulting network dynamics do not only show the actors involved and their relationships, but they also show the evolution of the ideas they work on by identifying the main topics under investigation within the projects.

This mapping method has the advantage that it allows the study of different phases in the network based primarily on the network data. Other authors have used somewhat similar approaches with longitudinal network data to construct different networks over time. For instance Rosenkopf and Tushman (1998) used survey data to mark different network phases. In a similar vein Soh and Roberts (2003) used the establishment of a dominant design in the ICT sector to designate three different phases, resulting in three separate networks. However, these studies have specified their network phases prior to the start of the network analysis. The mapping technique presented in chapter 6 allows for more detail in the study of network phases.

Some additional work needs to be done using social network analysis on the interaction between niches and socio-technical regimes. However, one of the weak points of the multi-level perspective is that the concepts of niches and regimes are not clearly demarcated. This thesis shows that the application of dynamic network analysis in transition studies can help to answer calls for more methodological rigour in the application of the MLP (Genus and Coles, 2008; Smith et al., 2010).

### 7.3.3 Implications for reflexive governance approaches to persistent complex problems

In the introduction of this thesis, the work of Ulrich Beck was shortly discussed. Beck has argued that some of the most central and pressing problems of 'unsustainability' we face today, are in fact the by-product of earlier phases in the modernisation process of western society. The modernisation of western society has produced a number of problems that have slowly become increasingly pronounced as more and more people started to find the associated risks of these problems unacceptable. Solving these problems however, has proven more difficult than expected. Reflexive governance approaches, such as Strategic Niche Management and Transition Management have developed as an attempt solve these persistent problems and the concept of sustainable development is an important guiding vision for these approaches. Multidisciplinary collaborations and knowledge co-creation together with stakeholders form the core of a turn towards a more 'reflexive modernisation'. However one of the core problems of these approaches is the relation between researchers involved and the stakeholders they work with.

The various chapters in this thesis show that the potential success of stakeholder participation depends to a large extent on the type of complexity that characterises the problem under study: cognitive, socio-political, or normative complexity (see in the introduction). The cases show that stakeholder participation can be an excellent way to reduce normative and socio-political complexity. The Sustainability Balance Sheet described in chapter 2 and the example of the landscape management vision pioneered by the farmer cooperatives VEL and Vanla described in chapters 5 and 6 illustrate this point. The Sustainability Balance Sheet depends on stakeholder participation for agenda building and developing a shared discourse on sustainable regional development. However, this vision is rather static, the SBS takes a 'photo' of a region and does not really concern itself with possible feedbacks within the system, nor with the different non-linear properties that contribute to the emergence of cognitive complexity. Stakeholder participation in the SBS is therefore merely concerned with the reduction of socio-political and normative complexity.

The case of landscape conservation in the Northern Frisian Woodlands further underscores this point. The landscape management path that has been developed in the Northern Frisian Woodlands proved to be relatively straightforward. It required a change in discourse, especially for the farmers unions in the regions, but once that was done the acceptance of the management scheme proved to be acceptable to all other stakeholders involved. After some initial experimental projects involving landscape management on farms, this idea was institutionalised in policy

at the national level within 10 years. Part of this success can be explained by the fact that landscapes are social constructs with an important cultural historical element in them. Cognitive complexity is fairly low in these cases and landscape conservation therefore lends itself very well for participatory approaches.

However, the success of stakeholder participation becomes different when cognitive complexity rears up its ugly head. The other main path of the environmental cooperatives in the NFW focussing on mineral management, manure quality and its application on grass lands, serves as an example of how the underlying biophysical and ecological processes greatly diminishes the space for stakeholders to work in. The idea of the integrated approach to nutrient management, depended on several biophysical processes, adding a layer of cognitive complexity that was hard to crack. Over time attention thus focused on different systemic properties: from using additives to improve manure quality, to different applications method of the manure on the fields, and finally on the effects on the soil and the organisms living in the soil. The cognitive complexity of agricultural systems that links human systems, soils, animals, grass lands and manure in a comprehensive systemic view are very difficult to understand, not just for the stakeholders involved, but also for scientific experts. Ironically, the main conflict about the interpretation of the results of the field experiments occurred between two groups of scientists involved. The lesson here is that attempts to deal with the inherent cognitive complexity of coupled human-ecological systems, remains one of the most difficult aspects to deal with for all actors involved. When scientists question the ability of stakeholder to contribute to this discussion, they overestimate their own partial knowledge of the system.

## 7.4 Recommendations for further research

Four years seems like a long time, especially before the start of a PhD study. However, ‘time flies when you’re having fun’ and at the end of this period some questions remain. Some of these remain because time ran out, other questions are new questions that have popped up because of some of the findings of this thesis also raise new issues for investigation. In this section some recommendations for further research will be made.

In the introduction a point was made about the need to build a bridge between the different uses of the network concept in the social sciences and in physics. So far changes in network structure have been studied in the domain of physics, where large scale-less networks are shown to be the result of processes of preferential attachment at the node level (Barabási and Albert, 1999; Newman, 2003). Even though the evolution of the niche networks studied in this thesis are much smaller

than used in physics, the distribution of the network functions (institutional entrepreneurship and knowledge creation) seems to follow a power law. Time failed to investigate this phenomenon any further and since the tendency of collaborative networks to display this kind of property is well known by now, this line of inquiry was not pursued any further.

However, further research should focus on this process of attachment. At the niche level this means answering the question: who is involved in the definition of new projects and how are new partners sought? This is an important mechanism that shapes the network. Related to this question are the issues of the changing network positions that the actors take up in the network over time. Some actors have risen to prominence in the network over time, while others gradually have lost their central position. Questions regarding the change in influence over time (and over different phases) together with the impact of a conflict on the position of certain actors in the network still need to be explored. Combining such a micro-level perspective with the macro-level characteristics of the network (path lengths, clustering coefficients and so on) is interesting work that will add a more sociological perspective on the process of 'preferential attachment'.

The mapping method that was applied in chapter 6 is especially suited for the study of the type of bottom-up collaborative innovation networks that typify a niche. Other niches should be investigated in order to compare the different patterns of niche evolution. However, its applicability is not limited to transitions studies alone. It can also be used to investigate other types of collaborative innovation networks. For instance focussing on the internal R&D projects within a large corporation in which different departments collaborate together. Another option would be to investigate the joint ventures between firms, or the research network that is formed by the different university groups that have received a grant from an annual research fund.

A final area worth of further investigation is the possibility to combine a discourse approach, especially one using Q-methodology and social networks as a way to quantitatively map out the existing discourse coalitions. The case of the NFW illustrates how discourses change with a changing network: from a typical agri-ruralist perspective in the first two phases, to a more hedonist the discourse in the last phase focussing on regional development and broadening the network with non-agrarian actors. It would be interesting to further investigate this link using the idea of 'discourse networks'. Some initial steps in this area have been taken in policy and political studies (Mische and Pattison, 2000; Schneider and Leifeld, 2007) and this constitutes a very promising approach for the study of innovation and transitions as well.

## 7.5 Recommendations for policy makers

Now what does this all mean in terms of policy? First of all, one of the main bottlenecks for innovation is the lack of a shared vision of the future of the agricultural sector. The role of the countryside in the Netherlands is highly contested, making the room for some new initiatives to operate in very small. The competition between the different visions has become so intense that it has become counterproductive for innovation as a 'dialogue of the deaf' is easily created in this environment. The concept of Metropolitan Agriculture has the potential to surpass the existing controversies in the agricultural sector, however this requires from the government a more active role in facilitating and steering the debate about the future of the agricultural sector in a densely populated and urban country like the Netherlands.

Networking and collaborative networks have become very popular in Dutch agricultural innovation policy. However, institutional actors have a significant influence on the composition of innovation networks, for instance by setting the criteria necessary for an exemption, or to be eligible for funding. The requirement of the Ministry of Agriculture to involve scientists led to a network dominated by researchers, while the requirement of TransForum to move on to regional development saw the inclusion of new actors and the adoption of a more hedonistic discourse in the network. Thus, whether intentional or not, funding criteria shape the room for a niche to develop in. To overcome some of the existing biases in policy and science the "matched funding" mechanism in some innovation programme must be loosened. Matched funding favours vested interests and existing networks, since it is precisely these actors that are able to raise the necessary capital to compete for this kind of subsidy.

The last recommendation involves the organisation of multidisciplinary innovation projects. This thesis has shown the importance of multidisciplinary collaboration in solving complex problems. The notion of 'third spaces'(Kronjee and Nooteboom, 2008) has been proposed to spur innovation and let organisations collaborate more easily. However, the internal logic of the participating organisations sometimes severely limits some of the network functions an individual can perform within an innovative network: university researchers develop knowledge, but hardly perform any other network functions. The internal organisational criteria that different types of organisations use to measure their own performance is partly to blame. In order to break out of the Dutch Innovation Paradox, the actors of the so-called 'Golden Triangle' of research institutes, government and business, should work on their 'bridging potential'. Some internal organisational freedom and adapted yard sticks to measure performance with are as important for innovation as cooperation itself. This would mean for universities that scientists are evaluated not only on their

peer-reviewed publications, while government for government it would mean that it should stop prescribing in detail the expected outputs of an innovation project and also focus more attention on some of the possible social outcomes.

# References


Ackoff, R.A. (1974) Redesigning the Future: a Systems Approach to Societal Problems. Wiley, New York.

Addams, H., Proops, J. (2000) Social discourse and environmental policy: an application of Q methodology. Edward Elgar Publishing Limited, Cheltenham, UK; Northhampton MA, USA.

Ahuja, G. (2000) Collaboration Networks, Structural Holes, and Innovation: A Longitudinal Study. Administrative Science Quarterly 45, 425-455.

Akkerman, S., Admiraal, W., Simons, R.-J., Niessen, T. (2006) Considering Diversity: Multivoicedness in International Academic Collaboration. Culture & Psychology 12, 461-485.

Alkemade, F., Negro, S.O., Thompson, N.A., Hekkert, M.P., (2011) Towards a micro-level explanation of sustainability transitions: entrepreneurial strategies, Working Paper Series. Innovation Studies Utrecht, Utrecht University, Utrecht.

Anderson, B.S., Butts, C.T., Carley, K. (1999) The interaction of size and density with graph-level indices. Social Networks 21, 239-267.

Argyris, C., Schön, D.A. (1978) Organisational learning: a theory of action perspective. Addison-Wesley, Reading, MA.

Armitage, D., Marschke, M., Plummer, R. (2008) Adaptive co-management and the paradox of learning. Global Environmental Change 18, 86-98.

Arora, S., (2009) Knowledge Flows and Social Capital: A network perspective on rural innovation. Maastricht University, Maastricht.

Arts, B., Buizer, M. (2009) Forests, discourses, institutions: A discursive-institutional analysis of global forest governance. Forest Policy and Economics 11, 340-347.

Arts, B., Leroy, P. (2006) Institutional Dynamics in Environmental Governance. Springer, Dordrecht, The Netherlands.

Bakhtin, M.M. (1981) The dialogic imagination: four essays. University of Texas Press, Austin.

Barabási, A.-L., Albert, R. (1999) Emergence of Scaling in Random Networks. Science 286, 509-512.

Barry, J., Proops, J. (1999) Seeking sustainability discourses with Q methodology. Ecological Economics 28, 337-345.

Batagelj, V., Mrvar, A., Pajek - Program for Large Network Analysis, 1.26 ed. http://vlado.fmf.uni-lj.si/pub/networks/pajek.

Beck, U. (1999) World Risk Society. Polity Press in association with Blackwell Publishers Ltd., Cambridge, UK.

Beck, U., Giddens, A., Lash, S. (1996) Reflexive modernization; politics, tradition and aesthetics in the modern social order. Stanford University Press, Stanford USA.

Beers, P.J., Veldkamp, A., Hermans, F., van Apeldoorn, D., Vervoort, J.M., Kok, K. (2010) Future sustainability and images. Futures 42, 723-732.

Bekke, H., De Vries, J. (1994) De salto mortale van het Ministerie van Landbouw, Natuurbeheer en Visserij. Samson H.D. Tjeenk Willink, Alphen a/d Rijn.

Bender-DeMoll, S., McFarland, D.A. (2006) The Art and Science of Dynamic Network Visualization. Journal of Social Structure 7.

Berkhout, F., Smith, A., Stirling, A., (2004) Socio-technical regimes and transition contexts, in: Elzen, B., Geels, F.W., Green, K. (Eds.), System Innovation and the Transition to Sustainability: Theory, Evidence and Policy. Edward Elgar Cheltenham, pp. 48–75.

Bohunovsky, L., Jäger, J., Omann, I. Participatory scenario development for integrated sustainability assessment. Regional Environmental Change, 1-14.

Boonstra, W., (2006) How to account for stakeholders' perceptions in Dutch rural policy?, in: Van den Brink, M., Metze, T. (Eds.), Words matter in policy and planning. Netherlands Graduate School of Urban and Regional Research, Utrecht, pp. 145-155.

Borgatti, S.P., Foster, P.C. (2003) The Network Paradigm in Organizational Research: A Review and Typology. Journal of Management 29, 911-1013.

Borgatti, S.P., Mehra, A., Brass, D.J., Labianca, G. (2009) Network Analysis in the Social Sciences. Science 323, 892-895.

Borgstein, M.H., Leneman, H., Bos-Gorter, L., Brasser, A.E., Groot, A.M.E., Van de Kerkhof, M.F., (2007) Dialogen over verduurzaming van de Nederlandse landbouw; ambities en aanbevelingen vanuit de sector, Wettelijke Onderzoekstaken Natuur & Milieu; WOt-werkdocument 44. Wageningen UR, Wageningen.

Bossel, H. (1996) Deriving indicators of sustainable development. Environmental Modeling and Assessment 1, 193-218.

Brasser, E.A., Van de Kerkhof, M.F., Groot, A.M.E., Bos-Gorter, L., Borgstein, M.H., Leneman, H., (2007) Verslag van de Dialogen over Duurzame Landbouw in 2006, Wettelijke onderzoekstaken natuur en milieu; WOt werkdocument 66. Wageningen UR, Wageningen.

Brouwer, A., Vink, J., (2008) Bio-monitor jaarrapport 2008. Biologica, Utrecht.

Brown, S.R. (1980) Political Subjectivity, applications of Q methodology in political science. Yale University Press, New Haven, London.

Burgess, J., Chilvers, J. (2006) Upping the ante: a conceptual framework for designing and evaluating participatory technology assessments. Science and Public Policy 33, 713-728.

Burt, R.S. (2005) Brokerage and closure; an introduction to social capital. Oxford University Press, Oxford, UK.

Caniëls, M.C.J., Romijn, H.A. (2008) Actor networks in Strategic Niche Management: Insights from social network theory. Futures 40, 613-629.

Carey, D., Ernst, E., Oyomopito, R., Theisens, J., (2006) Strengthening innovation in the Netherlands: making better use of knowledge creation in innovation activities, Economics department working papers. OECD, Paris.

Carlsson, B., Stankiewicz, R. (1991) On the nature, function and composition of technological systems. Journal of Evolutionary Economics 1, 93-118.

Cash, D.W., Clark, W.C., Alcock, F., Dickson, N.M., Eckley, N., Guston, D.H., Jäger, J., Mitchell, R.B. (2003) Knowledge systems for sustainable development. Proceedings of the National Academy of Sciences of the United States of America 100, 8086-8091.

Chambers, R., Conway, G., (1992) Sustainable rural livelyhoods: practical concepts for the 21st century, IDS discussion paper 296. Institute of Development Studies, Brighton.

Checkland, P., Scholes, J. (1990) Soft systems methodology in action. John Wiley & Sons Ltd., Chichester.

Cobb, D., Dolman, P., O'Riordan, T. (1999) Interpretations of sustainable agriculture in the UK. Progress in human geography 23, 209-235.

Coglianese, C. (1999) Limits to consensus. Environment 41, 28-33.

Coglianese, C., (2002) Is Satisfaction Success? Evaluating Public Participation in Regulatory Policymaking, KSG Working Paper. Harvard University, John F. Kennedy School of Government.

Coleman, J.S. (1988) Social capital in the creation of human capital. American Journal of Sociology 94, Supplement: Organizations and Institutions: Sociological and Economic Approaches to the Analysis of Social Structure, S95-S120.

Cundill, G., Fabricius, C. (2009) Monitoring in adaptive co-management: Toward a learning based approach. Journal of Environmental Management 90, 3205-3211.

Cundill, G.N.R., Fabricius, C., Marti, N. (2005) Foghorns to the future: using knowledge and transdisciplinarity to navigate complex systems. Ecology and Society 10.

Dagevos, J., Te Poel, Y. (2004) Balans, kwaliteit en competentie-ontwikkeling. Kenniscentrum Duurzame Stad & Streekontwikkeling, Eindhoven.

Danielsen, F., Burgess, N.D., Balmford, A., Donald, P.F., Funder, M., Jones, J.P.G., Alviola, P., Balete, D.S., Blomley, T., Brashares, J., Child, B., Enghoff, M., Fjeldsa, J., Holt, S., Hübertz, H., Jensen, A.E., Jensen, P.M., Massao, J., Mendoza, M.M., Ngaga, Y., Poulsen, M.K., Rueda, R., Sam, M., Skielboe, T., Stuart-Hill, G., Topp-Jorgensen, E., Yonten, D. (2009) Local Participation in Natural Resource Monitoring: a Characterization of Approaches. Conservation Biology 23, 31-42.

Davies, B.B., Hodge, I.D. (2007) Exploring environmental perspectives in lowland agriculture: A Q methodology study in East Anglia, UK. Ecological Economics 61, 323-333.

De Haan, H., Kasimis, B., Redclift, M. (1997) Sustainable Rural Development. Ashgate Publishing, Aldershot/Brookfield/Singapore/ Sydney.

De Nooy, W., Mrvar, A., Batagelj, V. (2005) Exploratory Social Network Analysis with Pajek. Cambridge University Press, New York.

Degenne, A., Forsé, M. (1999) Introducing social networks. Sage publications, London, Thousand Oaks, New Delhi.

Deuten, J.J., (2003) Cosmopolitanising technologies; a study of four emerging technological regimes. Twente University, Enschede.

DiMaggio, P.J., (1988) Interest and agency in institutional theory, in: Zucker, L. (Ed.), Institutional patterns and culture. Ballinger Publishing Company, Cambridge MA, USA.

Dobson, A. (1996) Environment Sustainabilities: analysis and a typology. Environmental Politics 5, 401-428.

Dorada, S. (2005) Institutional Entrepreneurship, Partaking, and Convening. Organization Studies 26, 385-414.

Dryzek, J.S. (1997) The politics of the earth: environmental discourses. Oxford University Press, Oxford.

Dryzek, J.S., Berejikian, J. (1993) Reconstructive Democratic Theory. The American Political Science Review 87, 48-60.

Easterby-Smith, M., Crossan, M., Nicolini, D. (2000) Organizational learning: debates past, present and future. Journal of management studies 37, 783-796.

Elkington, J. (1998) Cannibals with forks: the triple bottom line of 21st century business. New Society Publishers, Gabriola Island, Canada.

Elzen, B., Leeuwis, C., Van Mierlo, B., (2008) Anchorage of Innovations: Assessing Dutch efforts to use the greenhouse effect as an energy source, Acting with science, technology and medicine. Society for Social Studies of Science and the European Association for the Study of Science and Technology, Rotterdam.

Endquist, C., Lundvall, B.A., (1993) Comparing the Danish and Swedish systems of innovation, in: Nelson, R. (Ed.), National Innovation Systems. Oxford University Press, New York.

Enserink, B., Patel, M., Kranz, N., Maestu, J. (2007) Cultural Factors as Co-Determinants of Participation in River Basin Management. Ecology and Society 12.

Eshuis, J., (2006) Kostbaar vertrouwen: een studie naar proceskosten en procesvertrouwen in beleid voor agrarisch natuurbeheer Mansholt Graduate School of Social Sciences. Wageningen University and Research Centre, Delft, Eburon.

Eshuis, J., Stuiver, M. (2005) Learning in context through conflict and alignment: Farmers and scientists in search of sustainable agriculture. Agriculture and Human Values 22, 137-148.

Eshuis, J., Stuiver, M., Verhoeven, F.P.M., Van der Ploeg, J.D. (2001) Goede mest stinkt niet; een studie over drijfmest, ervaringskennis en het terugdringen van mineralenverliezen in de melkveehouderij. Rurale sociologie, Wageningen universiteit, Wageningen.

Fairweather, J.R., Keating, N.C. (1994) Goals and Management Styles of New Zealand Farmers. Agricultural Systems 44, 181-200.

Fichter, K. (2009) Innovation communities: the role of networks of promotors in Open Innovation. R&D Management 39, 357-370.

Fischer, F., Hajer, M.A. (1999) Living with nature, environmental politics as cultural discourse. Oxford University Press, Oxford.

Freeman, C., (1988) A new national system of innovation, in: Dosi, G., Freeman, C., Nelson, R., Silverberg, G., Soete, L. (Eds.), Technical change and economic theory. Pinter, London.

Freeman, L. (1979) Centrality in Social Networks: Conceptual Clarification. Social Networks 1.

Frouws, J., (1993) Mest en Macht: een politiek-sociologische studie naar belangenbehartiging en beleidsvorming inzake de mestproblematiek in Nederland vanaf 1970/ Manure and Power: a politico-sociological study of interest articulation and policy formation concerning the manure problem in the Netherlands since 1970. Wageningen University, Wageningen.

Frouws, J. (1998) The Contested Redefinition of the Countryside. An Analysis of Rural Discourses in The Netherlands. Sociologia Ruralis 38, 54-68.

Frouws, J., Van Tatenhove, J. (1993) Agriculture, environment and the state: the development of agro-environmental policy-making in the Netherlands. Sociologia Ruralis 33, 220-239.

Funtowicz, S.O., Ravetz, J.R. (1993) Science for the Post-Normal Age. Futures 25, 739-755.

Geels, F.W. (2002) Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. Research Policy 31, 1257-1274.

Geels, F.W., (2004) Understanding the Dynamics of Technological Transitions: A co-evolutionary and socio-technical analysis. Twente University, Enschede.

Geels, F.W. (2005) The dynamics of transitions in socio-technical systems: a multi-level analysis of the transition pathway from horse-drawn carriages to automobile (1860- 1930). Technology Analysis & Strategic Management 17, 445-476.

Geels, F.W. (2006) The hygienic transition from cesspools to sewer systems (1840-1930): the dynamics of regime transformation. Research Policy 35, 1069-1082.

Geels, F.W., Raven, R. (2006) Non-linearity and Expectations in Niche-Development Trajectories: Ups and Downs in Dutch Biogas Development (1973-2003). Technology Analysis & Strategic Management 18, 375-392.

Geels, F.W., Schot, J. (2007) Typology of sociotechnical transition pathways. Research Policy 36, 399-417.

Genus, A., Coles, A.-M. (2008) Rethinking the multi-level perspective of technological transitions. Research Policy 37, 1436-1445.

Gibbons, M. (1999) Science's new social contract with society. Nature 402, C81-C84.

Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., M, T. (1994) The new production of knowledge of knowledge: the dynamics of science and research in contemporary societies. Sage Publications, London, UK.

Giddens, A. (1984) The constitution of society: outline of the theory of structuration. Polity Publishers, Cambridge.

Gildemacher, P.R., Kaguongo, W., Ortiz, O., Tesfaye, A., Woldegiorgis, G., Wagoire, W.W., Kakuhenzire, R., Kinyae, P.M., Nyongesa, M., Struik, P.C., Leeuwis, C. (2009) Improving Potato Production in Kenya, Uganda and Ethiopia: A System Diagnosis. Potato Research 52, 173-205.

Glaser, B.G., Strauss, A.L. (1967) The discovery of grounded theory. Aldine, Chicago.

Gössling, T., Oerlemans, L.A.G., Jansen, R. (2007) Inside networks: a process view on multi-organisational partnerships alliances and networks. Edward Elgar, Cheltenham, UK; Northampton, MA, USA.

Grijzen-Schreurs, C.A.M.J., (2005) Bestuurskunst als 'blik'opener? Procesgang rond het manifest Brabant 2050; een onderzoek naar de interactie tussen overheid en samenleving in Brabant. Tilburg University, Tilburg.

Grin, J., (2010) Understanding transitions from a governance perspective, in: Grin, J., Rotmans, J., Schot, J. (Eds.), Transitions to sustainable development:

new directions in the study of long term transformative change. Routledge, Oxford.
Grin, J., Rotmans, J., Schot, J. (2010) Transitions to Sustainable Development; New Directions in the Study of Long Term Transformative Change. Routledge, Oxford, UK.
Grin, J., Rotmans, J., Schot, J. (2011) On patterns and agency in transition dynamics: Some key insights from the KSI programme. Environmental Innovation and Societal Transitions 1, 76-81.
Groot, J.C.J., Rossing, W.A.H., Lantinga, E.A. (2006) Evolution of farm management, nitrogen efficiency and economic performance on Dutch dairy farms reducing external inputs. Livestock Science 100, 99-110.
Grosskurth, J., Rotmans, J. (2005) The Scene model: getting a grip on sustainable development in policy making. Environment, Development and sustainability 7, 135-151.
Guijt, I., (2008) Seeking Surprise: Rethinking monitoring for collective learning in the rural resource management. Wageningen University, Wageningen.
Haarmann, W., Hermans, F., Overeem, I., (2004) Monitoring van provinciale duurzame ontwikkeling, de duurzaamheidbalans getoetst in vier provincies. Telos, Tilburg.
Hackert, C., Braehler, G., (2007) FlashQ, version 1.0 ed.
Hacking, T., Guthrie, P. (2006) Sustainable Development Objectives in Impact Assessment: Why are they needed and where do they come from? Journal of Environmental Assessment Policy and Management 8, 341-371.
Hajer, M.A. (1995) The Politics of Environmental Discourse. Ecological Modernization and the Policy Process. Oxford University Press, Oxford.
Hajer, M.A., (2006) Doing discourse analysis: coalitions, practices, meaning, in: Van den Brink, M., Metze, T. (Eds.), Words matter in policy and planning; discourse theory and method in the social sciences. Koninklijk Nederlands Aardrijkskundig Genootschap; Netherlands Graduate School of Urban and Regional Research, Utrecht 2006.
Hall, A., Rasheed Sulaiman, V., Clark, N., Yoganand, B. (2003) From measuring impact to learning institutional lessons: an innovation systems perspective on improving the management of international agricultural research. Agricultural Systems 78, 213-241.
Handcock, M.S., Hunter, D.R., Butts, C.T., Goodreau, S.M., Morris, M., (2003) Software Tools for the Statistical Modeling of Network Data. , 2.1 ed.
Hauschildt, J., Kirchmann, E. (2001) Teamwork for innovation - The 'troika' of promotors. R and D Management 31, 41-49.
Head, B. (2008) Assessing network-based collaborations. Public Management Review 10, 733-749.

Hekkert, M.P., Suurs, R.A.A., Negro, S.O., Kuhlmann, S., Smits, R.E.H.M. (2007) Functions of innovation systems: a new approach for analysing technological change. Technological Forecasting & Social Change 74, 413-432.

Hermans, F., Dagevos, J. (2006) De Duurzaamheidbalans van Brabant 2006. Telos, Tilburg.

Hermans, F., Knippenberg, L. (2006) A principle-based approach for the evaluation of sustainable development. journal of environmental assessment policy and management 8, 299-320.

Hermans, L.M., Thissen, W.A.H. (2009) Actor analysis methods and their use for public policy analysts. European Journal of Operational Research 196, 808-818.

Hinssen, J.P.P., Horlings, I., Hermans, F., (2010) Botsende beelden; over innoveren bij maatschappelijke tegenwind - een vertooganalyse over het nieuw gemengd bedrijf. Telos, Tilburg.

Hisschemoller, M., Hoppe, R., (2001) Coping with intractable controversies: the case for problem structuring in policy design and analysis, in: Hisschemoller, M., Hoppe, R., Dunn, W., Ravetz, J.R. (Eds.), Knowledge, Power and Participation in Environmental Policy Analysis. Transaction Publishers, New Jersey, USA.

Hodge, T. (1997) Toward a conceptual framework for assessing progress toward sustainability. Social Indicators Review 40, 5-98.

Horlings, I., (1997) Agricultural change and innovation groups in the Netherlands, in: De Haan, H., Kasimis, B., Redclift, M. (Eds.), Sustainable Rural Development. Ashgate, Aldershot/Brookfield/Singapore/Sydney, pp. 159-178.

Horlings, I., Marsden, T. (2011) Towards the real green revolution? Exploring the conceptual dimensions of a new ecological modernisation of agriculture that could 'feed the world'. Global Environmental Change 21, 441-452.

Horlings, I., Tops, P., Ostaaijen, J., Cornelissen, E., (2006) Vital Coalitions, in: Latesteijn, H.v., Mommaas, H. (Eds.), The organisation of innovation and transition. TransForum, Zoetermeer, pp. 3-36.

Horlings, I., Tops, P., Van Ostaaijen, J., (2009) Regimes and vital coalitions in rural-urban regions in the Netherlands, in: Andersson, K., Lehtola, M., Eklund, E., Salmi, P. (Eds.), Beyond the rural-urban divide: cross-continental perspectives on the differentiated countryside and its regulation. Emerald, Bingley.

Howell, J.M., Higgins, C.A. (1990) Champions of change: Identifying, understanding, and supporting champions of technological innovations. Organizational Dynamics 19, 40-55.

Howells, J. (2006) Intermediation and the role of intermediaries in innovation. Research Policy 35, 715-728.

IAASTD (2009) International assessment of agricultural knowledge, science and technology for development: global report. Island Press, Washinton D.C.

Innes, J.E., Booher, D.E. (2004) Reframing Public Participation Strategies for the 21st Century. Planning Theory and Practice 5, 419-436.

Jacobs, M., (1999) Sustainable development as a contested concept, in: Dobson, A. (Ed.), Fairness and Futurity: essays on environmental sustainability and social justice. Oxford University Press, Oxford.

Janssen, J. (2006) Vooruit denken en verwijlen; de (re)constructie van het plattelandschap in Zuidoost-Brabant, 1920-2000. Stichting Zuidelijke Historisch Contact Tilburg, Tilburg, The Netherlands.

Janssen, M., (2002) A Future of Surprises, in: Gunderson, L.H., Holling, C.S. (Eds.), Panarchy; understanding transformations in human and natural systems. Island Press, Washington, Covelo, London, pp. 241-260.

Kasemir, B., Jäger, J., Jaeger, C.C., Gardner, M.T. (2003) Public participation in sustainability science. Cambridge University Press, Cambridge.

Kemp, R., Rip, A., Schot, J., (2001) Constructing Transition Paths through the Management of Niches,, in: Garud, R., Karnøe, P. (Eds.), Path Dependence and Creation. Lawrence Erlbaum Associates, Publishers, London, pp. 269-299.

Kemp, R., Rotmans, J., (2004) Managing the transition to sustainable mobility, in: Elzen, B., Geels, F.W., Green, K. (Eds.), System Innovation and the Transition to Sustainability. Edward Elgar Publishing Ltd., Cheltenham, pp. 137-167.

Kemp, R., Schot, J., Hoogma, R. (1998) Regime shifts to sustainability through processes of niche formation: The approach of strategic niche management. Technology Analysis & Strategic Management 10, 175 - 198.

Kirkels, Y., Duysters, G. (2010) Brokerage in SME networks. Research Policy 39, 375-385.

Klein Woolthuis, R., Lankhuizen, M., Gilsing, V. (2005) A system failure framework for innovation policy design. Technovation 25, 609-619.

Klerkx, L., Aarts, N., Leeuwis, C. (2010) Adaptive Management in agricultural innovation systems: The interactions between innovation networks and their environment. Agricultural Systems 103.

Klerkx, L., Hall, A., Leeuwis, C. (2009) Strengthening agricultural innovation capacity: are innovation brokers the answer? International Journal of Agricultural Resources, Governance and Ecology 8, 409-438.

Klerkx, L., Leeuwis, C. (2009) Establishment and embedding of innovation brokers at different innovation system levels: Insights from the Dutch

agricultural sector. Technological Forecasting & Social Change 76, 849-860.

Knippenberg, L., Haarmann, W., Hermans, F.L.P., Beckers, T.A.M., Dagevos, J., Overeem, I., (2007) Developing Tools for the Assessment of Sustainable Development in the Province of Brabant, The Netherlands, in: Hak, T., Moldan, B., Lyon Dahl, A. (Eds.), Sustainability Indicators: A Scientific Assessment. Island Press, Washington D.C.

Knippenberg, L.W.J., Hermans, F.L.P., Haarmann, W.M.F., (2005) Towards Assessment for Sustainability, in: Latesteijn, H.v., Mommaas, H. (Eds.), The Organisation of Innovation and Transition. TransForum Agro en Groen, Zoetermeer, pp. 62-86.

Knoben, J., Oerlemans, L.A.G., Rutten, R.P.J.H. (2006) Radical changes in inter-organizational network structures: the longitudinal gap. Technological Forecasting & Social Change 73, 390-404.

Knoke, D., Yang, S. (2008) Social network analysis; second edition, 2nd ed. Sage Publications, Los Angeles.

Kok, K., Patel, M., Rothman, D.S., Quaranta, G. (2006a) Multi-scale narratives from an IA perspective: Part II. Participatory local scenario development. Futures 38, 285-311.

Kok, K., Rothman, D.S., Patel, M. (2006b) Multi-scale narratives from an IA perspective: Part I. European and Mediterranean scenario development. Futures 38, 261-284.

Kronjee, G., Nooteboom, B., (2008) Research, higher education, and innovation, in: Nooteboom, B., Stam, E. (Eds.), Micro-foundations for innovation policy. Amsterdam University Press, Amsterdam.

Leca, B., Battilana, J., Boxenbaum, E., (2008) Agency and institutions: a review of institutional entrepreneurship, Working Paper. Harvard Business School.

Leeuwis, C. (2000) Reconceptualizing Participation for Sustainable Rural Development: Towards a Negotiation Approach. Development and Change 31, 931-959.

Leeuwis, C., Pyburn, R. (2002) Wheelbarrows full of frogs; Social learning in rural resource management. Koninklijke Van Gorcum BV, Assen.

Leeuwis, C., Smits, R., Grin, J., Klerkx, L., Van Mierlo, B., Kuipers, A., (2006) Equivocations on the post privatization dynamics in agricultural innovation systems, in: Smits, R. (Ed.), The Design of an Innovation-enhancing environment. TransForum, Zoetermeer.

Leeuwis, C., Van den Ban, A.W. (2004) Communication for Rural Innovation: Rethinking Agricultural Extension. Blackwell Science, Oxford.

Lemmens, L., Haarmann, W., (2002) De Duurzaamheidbalans van Brabant 2002. Telos, Tilburg.

Lemmens, L., Ten Caten, H., Tabibian, N., (2001) De Duurzaamheidbalans van Noord-Brabant 2001. Telos, Tilburg.

Leys, A., Vanclay, J. (2011) Stakeholder engagement in social learning to resolve controversies over land-use change to plantation forestry. Regional Environmental Change 11, 175-190.

Lindahl, T., Söderqvist, T. (2004) Building a catchment-based environmental programme: a stakeholder analysis of wetland creation in Scania, Sweden. Regional Environmental Change 4, 132-144.

Loorbach, D., (2007) Transition management; new mode of governance for sustainable development, Drift, Dutch Research Institute for Transitions. Erasmus University, Rotterdam, Rotterdam.

Loorbach, D., Rotmans, J., (2006) Managing transitions for sustainable development, in: Olshoorn, X., Wieczorek, A. (Eds.), Understanding Industrial Transformation: Views from Different Disciplines. Springer, pp. 187-206.

Lounsbury, M., Crumley, E.T. (2007) New Practice Creation: An Institutional Perspective on Innovation. Organization Studies 28, 993-1012.

Lukkenaer, D., Dagevos, J., Smeets, R. (2009) Staat van Utrecht: duurzaamheidmeting 2008. Provincie Utrechtr, Utrecht.

Malthus, T.R. (1798) An essay on the principle of population. J. Johnson, in St. Paul's Church-yard, London.

Markard, J., Truffer, B. (2008a) Actor-oriented analysis of innovation systems: exploring micro-meso level linkages in the case of the stationary fuel cells. Technology Analysis & Strategic Management 20, 443-464.

Markard, J., Truffer, B. (2008b) Technological innovation systems and the multi-level perspective: Towards an integrated framework. Research Policy 37, 596-615.

Marsden, T. (2003) The Condition of Rural Sustainability. Royal Van Gorcum, Assen, The Netherlands.

Mayer, I.S. (1997) Debating technologies: a methodological contribution to the design and evaluation of participatory policy analysis. Tilburg University Press, Tilburg.

McKeown, B., Thomas, D. (1988) Q-Methodology. Sage University Paper, Beverly Hills.

Meadowcroft, J. (2005) Environmental political economy, technological transitions and the state. New Political Economy 10, 479-498.

Mebratu, D. (1998) Sustainability and sustainable development: historical and conceptual review. Environmental Impact Assessment Review 18, 493-520.

Meeus, M.T.H., Oerlemans, L.A.G., Kenis, P., (2008) Inter-organisational networks and innovation, in: Nooteboom, B., Stam, E. (Eds.), Micro-

foundations for innovation policy. Amsterdam University Press, Amsterdam.
Mische, A., Pattison, P. (2000) Composing a civic arena: Publics, projects, and social settings. Poetics 27, 163-194.
Mommaas, H., Janssen, J. (2008) Towards a synergy between 'content' and 'process' in Dutch spatial planning: the Heuvelland case Journal of Housing and the Built Environment 23, 21-35.
Moore, M.-L., Westley, F. (2011) Surmoutable chasms: networks and social innovation for resilient systems. Ecology and Society 15.
Mostert, E., Pahl-Wostl, C., Rees, Y., Searle, B., Tàbara, D., Tippett, J. (2007) Social Learning in European River-Basin Management: Barriers and Fostering Mechanisms from 10 River Basins. Ecology and Society 12, 19.
Murdoch, J., Lowe, P., Ward, N., Marsden, T. (2003) The Differentiated Countryside. Routledge, London.
Nelson, R., Winter, S. (1977) In search of a useful theory of innovation. Research Policy 6, 36-76.
Nelson, R.R., Nelson, K. (2002) Technology, institutions, and innovation systems. Research Policy 31, 265-272.
Newig, J., Günther, D., Pahl-Wostl, C. (2010) Synapses in the Network: Learning in Governance Networks in the Context of Environmental Management. Ecology and Society 15, 24.
Newman, M.E.J. (2003) The structure and function of complex networks. Siam Review 45, 167-256.
Nowotny, H., Scott, P., Gibbons, M. (2003) 'Mode 2' revisited: The new production of knowledge - Introduction. Minerva 41, 179-194.
O'Connor, B.P. (2000) SPSS and SAS programs for determining the number of components using parallel analysis and Velicer's MAP test. Behaviour Research Methods, Instrumentation, and Computer 32, 396-402.
OECD, (2005) Economic Surveys: Netherlands. OECD, Paris.
Oerlemans, L.A.G., Gössling, T., Jansen, R., (2007) Inside Networks - A Process View on Inter-organisational Relationships and Networks, in: Gössling, T., Oerlemans, L.A.G., Jansen, R. (Eds.), Inside networks: a process view on multi-organisational partnerships, alliances and networks. Edward Elgar Publishing, Cheltenham, UK; Northampton, USA, pp. 3-11.
Pahl-Wostl, C., Craps, M., Dewulf, A., Mostert, E., Tàbara, D., Taillieu, T. (2007) Social learning and water resources management. Ecology and Society 12.
Pahl-Wostl, C., Hare, M. (2004) Processes of social learning in integrated resources management. Journal of Community & Applied Social Psychology 14, 193-206.

Pannell, D.J., Schilizzi, S. (1999) Sustainable Agriculture: A Matter of Ecology, Equity, Economic Efficiency or Expendience. Journal of Sustainable Agriculture 13, 57-65.

Pike, A., Rodríguez-Pose, A., Tomaney, J. (2007) What Kind of Local and Regional Development and for Whom? Regional Studies 41, 1253 - 1269.

Powell, W., W, White, D., R, Koput, K., W, Jason, O.-S. (2005) Network Dynamics and Field Evolution: The Growth of Interorganizational Collaboration in the Life Sciences. The American Journal of Sociology 110, 1132-1205.

Previte, J., Pini, B., Haslam-McKenzie, F. (2007) Q Methodology and Rural Research. Sociologia Ruralis 47, 135-147.

Provincie Noord-Brabant, (2001) Koepelplan Revitalisering landelijk gebied. Reconstructie aan zet. Provincie Noord-Brabant, 's Hertogenbosch.

Provincie Noord-Brabant, (2002) Brabant in Balans, streekplan Noord-Brabant. Provincie Noord-Brabant, 's Hertogenbosch.

Provincie Noord-Brabant, (2003) Bestuursakkoord 2003-2007; samenwerken aan uitvoering. Provincie Noord-Brabant, 's Hertogenbosch.

Putnam, R.D. (1993) The prosperous community: social capital and public life. American Prospect, 35-42.

Putnam, R.D. (2000) Bowling alone: The collapse and revival of American community. Simon & Schuster, New York.

R Development Core Team, (2008) R: A language and environment for statistical computing, 2.8.0 ed. Foundation for Statistical Computing, Vienna, Austria.

Raven, R., Van den Bosch, S., Weterings, R. (2010) Transitions and strategic niche management: towards a competence kit for practitioners. International Journal of Technology Management 51, 57-74.

Raven, R.P.J.M., (2005) Strategic niche management for biomass: a comparative study on the experimental introduction of bioenergy technologies in the Netherlands and Denmark. Eindhoven University of Technology, Eindhoven.

Reed, M., Fraser, E.D., Dougill, A.J. (2006) An adaptive learning process for developing and applying sustainability indicators with local communities. Ecological Economics 59, 406-418.

Reed, M.S., Evely, A.C., Cundill, G.N.R., Fazey, I., Glass, J., Laing, A., Newig, J., Parrish, B., Prell, C., Raymond, C., Stringer, L.C. (2010) What is social learning? Ecology and Society 15.

Regeer, B.J., (2009) Making the invisible visible; analysing the development of strategies and changes in knowledge production to deal with persistent problems in sustainable development. Vrije Universiteit, Amsterdam.

Reijs, J.W., Sonneveld, M.P.W., Sørensen, P., Schils, R.L.M., Groot, J.C.J., Lantinga, E.A. (2007) Effects of different diets on utilization of nitrogen from cattle slurry applied to grassland on a sandy soil in The Netherlands. Agriculture, Ecosystems and Environment 118, 65-79.

Renting, H., Van Der Ploeg, J.D. (2001) Reconnecting nature, farming and society: Environmental cooperatives in the Netherlands as institutional arrangements for creating coherence. Journal of Environmental Policy and Planning 3, 85-101.

Ridder, D., Pahl-Wostl, C. (2005) Participatory Integrated Assessment in local level planning. Regional Environmental Change 5, 188–196.

Rip, A., Kemp, R., (1998) Technological change, in: Rayner, S., Malone, E.L. (Eds.), Human Choice and Climate Change, pp. 327-399.

Ritter, H., Webber, M. (1973) Dilemmas in General Theory of Planning. Policy sciences 4, 155-169.

Robinson, J. (2004) Squaring the circle? Some thoughts on the idea of sustainable development. Ecological Economics, 369-384.

Roelofs, A.M.E., (2000) Structuring policy issues, testing and mapping techniques with gaming-simulation. Tilburg University, Tilburg.

Roep, D., Van der Ploeg, J.D., Wiskerke, J.S.C. (2003) Managing technical-institutional design processes: some strategic lessons from environmental co-operatives in the Netherlands. Netherlands Journal of Agricultural Science 51, 195-217.

Rogers, E.M. (2003) Diffusion of Innovations, 5th edition ed. Free Press, New York.

Röling, N.G., Wagemakers, M.A.E. (1998) Social learning for sustainable agriculture: participatory learning and adaptive management in times of environmental uncertainty. Cambridge University Press, Cambridge.

Rosenkopf, L., Tushman, M. (1998) The co-evolution of community networks and technology: lessons from the flight simulation industry. Industrial and Corporate Change 7, 311-346.

Rotmans, J. (2003) Transitiemanagement; sleutel voor een duurzame samenleving. Van Gorcum, Assen.

Rotmans, J., Grosskurth, J., Asselt, M.v., Loorbach, D., (2001a) Duurzame ontwikkeling, van concept naar uitvoering. ICIS, Universiteit van Maastricht, Maastricht.

Rotmans, J., Kemp, R., Van Asselt, M.B.A. (2001b) More evolution than revolution: transition management in public policy. Foresight 3, 15-31.

Rotmans, J., Loorbach, D., (2010) Towards a better understanding of transitions and their governance: a systemic and reflexive approach, in: Grin, J., Rotmans, J., Schot, J. (Eds.), Transitions to Sustainable Development; New

Directions in the Study of Long Term Transformative Change. Routledge, Oxford, pp. 105-222.
Rowe, G., Frewer, L.J. (2005) A Typology of Public Engagement Mechanisms. Science, Technology & Human Values 30, 251-290.
Sabatier, P.A. (1988) An advocacy coalition framework of policy change and the role of policy-oeriented lerning therein. Policy sciences 21, 129-168.
Schmolck, P., (2002) PQMethod, version 2.11 ed.
Schneider, V., Leifeld, P., (2007) Belief Systems, Discourse Networks and Institutional Communication in Policy Making: A Second Look on Chemicals Regulation in Germany in the 1980s. University of Konstanz.
Schon, D.A. (1963) Champions for radical new inventions. Harvard Business Review 41, 77-86.
Schot, J., Geels, F.W. (2007) Niches in evolutionary theories of technical change. Journal of Evolutionary Economics 17, 605-622.
Schot, J., Geels, F.W. (2008) Strategic niche management and sustainable innovation journeys: theory, findings, research agenda en policy. Technology Analysis & Strategic Management 20, 537-554.
Schot, J., Hoogma, R., Elzen, B. (1994) Strategies for shifting technological systems: the case of the automobile industry. Futures 26, 1060-1076.
Scoones, I. (2009) Livelihoods perspectives and rural development. Journal of Peasant Studies 36, 171-196.
Serageldin, I. (1996) Sustainability and the Wealth of Nations, first steps in an ongoing journey. The World Bank, Washington D.C.
Smith, A. (2006) Green niches in sustainable development: the case of organic food in the United Kingdom. Environment and Planning C: Government and Policy 24, 439-458.
Smith, A. (2007) Translating Sustainabilities between Green Niches and Socio-Technical Regimes. Technology Analysis & Strategic Management 19, 427 - 450.
Smith, A., Kern, F. (2009) The transitions storyline in Dutch environmental policy. Environmental Politics 18, 78-98.
Smith, A., Voss, J.-P., Grin, J. (2010) Innovaton studies and sustainability transitions: The allure of the multi-level perspective and its challenges. Research Policy 39, 435-448.
Soh, P.-H., Roberts, E.B. (2003) Networks of innovators: a longitudinal perspective. Research Policy 32, 1569-1588.
Sonnino, R., Kanemas, Y., Marsden, T., (2008) Sustainability and rural development, in: Van der Ploeg, J.D., Marsden, T. (Eds.), Unfolding webs; the dynamics of regional, rural development. Van Gorcum, Assen.

Spielman, D., Davis, K., Negash, M., Ayele, G. (2010) Rural innovation systems and networks: findings from a study of Ethiopian smallholders. Agriculture and Human Values, 1-18.

Spielman, D.J., Ekboir, J., Davis, K., Ochieng, C.M.O. (2008) An innovation systems perspective on strengthening agricultural education and training in sub-Saharan Africa. Agricultural Systems 98, 1-9.

Steelman, T.A., Maguire, L.A. (1999) Understanding participant perspectives: Q-methodology in national forest management. Journal of policy analysis and management 18, 361.

Stoker, G., (1995) Regime theory and urban politics, in: Judge, D., Stoker, G., Wolman, H. (Eds.), Theories of Urban Politics. Sage publications, London.

Stokman, F.N., (2001) Networks: social, International Encyclopedia for the Social and Behavioural Sciences, pp. 10509-10514.

Stokman, F.N., Doreian, P., (1997) Evolution of social networks: processes and principles, in: Doreian, P., Stokman, F.N. (Eds.), Evolution of social networks. Gordon and Breach Publishers, Amsterdam.

Stone, C.N. (1989) Regime Politics. Governing Atlanta 1946-1988. University Press, Kansas.

Stone, C.N. (1993) Urban Regimes and the Capacity to Govern. Journal of Urban Affairs 15, 1-28.

Strauss, A.L. (1987) Qualitative analysis for social scientists. Cambridge University Press, Cambridge, UK.

Stringer, L.C., Dougill, A.J., Fraser, E., Hubreck, K., Prell, C., Reed, M.S. (2006) Unpacking "Participation" in the Adaptive Management of Social-ecological Systems: a Critical Review. Ecology and Society 11.

Stuiver, M., (2008) Regime Change and Storylines, a sociological analysis of manure practices in contemporary Dutch dairy farming, Mansholt Graduate School of Social Sciences. Wageningen University and Research Center, Wageningen.

Stuiver, M., Van der Ploeg, J.D., Leeuwis, C. (2003) The VEL and VANLA environmental co-operatives as field laboratories. Netherlands Journal of Agricultural Science 51, 27-39.

Stuiver, M., Wiskerke, J.S.C., (2004) The VEL and VANLA Environmental Co-Operatives as a Niche for Sustainable Development, in: Wiskerke, J.S.C., Van der Ploeg, J.D. (Eds.), Seeds of Transition: Essays on Novelty Production, Niches and Regimes in Agriculture. Royal Van Gorcum, Assen.

Swedeen, P. (2006) Post-normal science in practice: A Q study of the potential for sustainable forestry in Washington State, USA. Ecological Economics 57, 190.

Termeer, C.J.A.M., Breeman, G.E., Van Lieshout, M., (2009) RMNO Conference 2009: Trust, knowledge, and democracy. The public debate about Dutch mega-stables, in: Van Altvorst, A.C. (Ed.), Towards Knowledge Democracy. Consequences for Science, Politics and Media, Leiden.

Thompson, M., Ellis, R., Wildawsky, A. (1990) Cultural Theory. Westview Press, Boulder, Colorado.

Tovey, H. (2008) Introduction: Rural Sustainable Development in the Knowledge Society Era. Sociologia Ruralis 48, 185.

Van Apeldoorn, D., Sonneveld, M.P.W., Kok, K. (2011) Landscape asymmetry of soil organic matter as a source of agro-ecosystem resilience. Agriculture, Ecosystems & Environment 140, 401-410.

Van Asselt, M.B.A., Rijkens-Klomp, N. (2002) A look in the mirror: reflection on participation in Integrated Assessment from a methodological perspective. Global Environmental Change 12, 167-184.

Van Bueren, E.M., Klijn, E.-H., Koppenjan, J.F.M. (2003) Dealing with wicked problems in networks: analyzing an environmental debate from a network perspective. Journal of public adminstration research and theory 13, 193-212.

Van de Kerkhof, M., Wieczorek, A. (2005) Learning and stakeholder participation in transition processes towards sustainability: Methodological considerations. Technological Forecasting & Social Change 72, 733-747.

Van de Poel, I. (2000) On the role of outsiders in technical development. Technology Analysis & Strategic Management 12, 383-397.

Van den Brink, A., (1990) Structuur in beweging: het landbouwstructuurbeleid in Nederland 1945-1985, Agrarische economie en plattelandsbeleid. Landbouwuniversiteit Wageningen, Wageningen, p. 301.

Van den Brink, M., Metze, T. (2006) Words matter in policy and planning: discourse theory and method in the social sciences. Netherlands Graduate School of Urban and Regional Research, Utrecht.

Van der Brugge, R., Rotmans, J., Loorbach, D. (2005) The transition in Dutch water management. Regional Environmental Change 5, 164-176.

Van der Ploeg, J.D. (2000) Rural Development: From Practices and Policies towards Theory. Sociologia Ruralis 40, 391.

Van der Ploeg, J.D., Bouma, J., Rip, A., Rijkenberg, F.H.J., Flaminia, V., Wiskerke, J.S.C., (2004) On Regimes, Novelties, Niches and Co-Production, in: Wiskerke, J.S.C., Van Der Ploeg, J.D. (Eds.), Seeds of transition. Royal Van Gorcum, Assen.

Van der Ploeg, J.D., Strijker, D., Hoofwijk, H., (2007) Noordelijke Friese Wouden: leerervaringen. TransForum, Zoetermeer.

Van der Ploeg, J.D., Van Broekshuizen, R., Sonnino, G.B.R., Knickel, K., Tisenkopfs, T., Oostindie, H., (2008) Towards a framework for

understanding regional, rural development, in: Van der Ploeg, J.D., Marsden, T. (Eds.), Unfolding webs; the dynamics of regional rural development. Van Gorcum, Assen.

Van der Valk, T., Chappin, M.M.H., Gijsbers, G. (2011) Evaluating innovation networks in emerging technologies. Technological Forecasting & Social Change 78, 358-370.

Van Eeten, M., (1999) Dialogues of the deaf: defining new agendas for environmental deadlocks, Department of Technology, Policy and Management; Delft University of Technology. Publisher: Eburon, Delft pp. XIII, 183p.

Van Latesteijn, H., Andeweg, K. (2011) The TransForum Model: TransForum Agro Innovation Toward Sustainable Development. Springer, Dordrecht.

Van Latesteijn, H.C., Veldkamp, A., Van Altvorst, A.C., Beers, P.J., Eweg, R., Fischer, A., (2008) TransForum: Organizing the transition towards Metropolitan Agriculture, Agriculture in Transition, Wageningen.

Van Tatenhove, J., Arts, B., Leroy, P., (2000) The institutionalisation of environmental politics, in: Van Tatenhove, J., Arts, B., Leroy, P. (Eds.), Political modernisation and the environment. Kluwer Academic Publishers, Dordrecht/Boston/London.

Van Vliet, M., (2011) Bridging gaps in the scenario world; linking stakeholders, modellers and decision makers, Land Dynamics Group. Wageningen UR, Wageningen.

Veldkamp, A., Altvorst, A.C.V., Eweg, R., Jacobsen, E., Kleef, A.V., Latesteijn, H.V., Mager, S., Mommaas, H., Smeets, P.J.A.M., Spaans, L., Trijp, J.C.M.V. (2009) Triggering transitions towards sustainable development of the Dutch agricultural sector: TransForum's approach. Agronomy for Sustainable Development 29, 87-96.

Vennix, J.A.M. (1999) Group-model building: tackling messy problems. System Dynamics Review 15, 379-401.

Vogelezang, J., Wals, A., Van Mierlo, B., Wijnands, F., (2009) Learning in networks in Dutch agriculture: stimulating sustainable development through innovation and change, in: Poppe, K.J., Termeer, C., Slingerland, M. (Eds.), Transitions towards sustainable agriculture and food chains in peri-urban areas. Wageningen Academic Publishers, Wageningen, The Netherlands.

Voss, J.-P., Bauknecht, D., Kemp, R. (2006) Reflexive governance for sustainable development. Edward Elgar Publishing, Cheltenham, UK; Northampton, USA.

Voss, J.-P., Bornemann, B. (2011) The Politics of Reflexive Governance: Challenges for Designing Adaptive Management and Transition Management. Ecology and Society 16.

Wasserman, S., Faust, K. (1994) Social Network Analysis. Cambridge University Press, Cambridge.

Weaver, P.M., Rotmans, J. (2006) Integrated Sustainability Assessment: what is it, why do it and how? International Journal of Innovation and Sustainable Development 4.

Wielinga, E., Geerling-Eijff, F., (2009) Networks with free actors: an organic approach to innovation and transition, in: Poppe, K., Termeer, C., Slingerland, M. (Eds.), Transitions; towards sustainable agriculture and food chains in peri-urban areas. Wageningen Academic Publishers, Wageningen, The Netherlands.

Wiskerke, J.S.C. (2009) On Places Lost and Places Regained: Reflections on the Alternative Food Geography and Sustainable Regional Development. International Planning Studies 14, 369-387.

Wiskerke, J.S.C., Bock, B.B., Stuiver, M., Renting, H. (2003) Environmental co-operatives as a new mode of rural governance. Netherlands Journal of Agricultural Science 51, 9-25.

Wiskerke, J.S.C., Van Der Ploeg, J.D. (2004) Seeds of Transition; essays on novelty production, niches and regimes in agriculture. Royal Van Gorcum, Assen.

Wisserhof, J., (2000) Agricultural Policy Making in the Netherlands: Beyond Corporatist Policy Arrangements?, in: Van Tatenhove, J., Arts, B., Leroy, P. (Eds.), Political Modernisation and the Environment, The Renewal of Environmental Policy Arrangements. . Kluwer Academic Publishers, Dordrecht, , pp. 175-197.

Witte, E. (1973) Organisation für Innovationsentscheidungen - Das Promotorenmodell. Schwart, Göttingen, Germany.

Witte, E. (1977) Power and innovation: a two center theory. International Studies of Management and Organisation 7, 47-70.

Wolsink, M. (2004) Book review: the condition of rural sustainability. Tijdschrift voor Economische en Sociale Geografie 91, 117-119.

World Bank (2006) Enhancing Agricultural Innovation: How to Go Beyond the Strengthening of Research Systems. World Bank, Washington.

World Commission on Environment and Development (1988) Our Common Future. Oxford University Press, Oxford.

Zografos, C. (2007) Rurality discourses and the role of the social enterprise in regenerating rural Scotland. Journal of Rural Studies 23, 38-51.

# Summary

The increasing complexity of modern day society has led to the emergence of a specific type of sustainability problems known as complex problems. These types of problems can be characterised by their cognitive complexity and inherent insecurity, their normative complexity that allows for completely different interpretations rooted in different worldviews and finally the occurrence of a conflict of interests between different actors.

Sustainable agriculture is the case in point. The Dutch countryside is standing on the threshold of a major transition. Rural development in The Netherlands nowadays involves far more than just restructuring agricultural production. The linear innovation perspective where new knowledge was discovered at universities and subsequently transferred to farmers by means of government sponsored extension services has given way to a new perspective on innovation. This perspective takes a relational view on innovation in which knowledge and innovations are co-created together with stakeholders and it emphasises the importance of experimentation and social learning involving a multisectoral network of actors from science, businesses, government agencies and non-governmental organisations. The aim of these collaborative innovation networks is to contribute to the transition to sustainable agriculture, a radical and structural change of the agricultural system as a whole.

This thesis focuses on these innovation networks in the context of sustainable agriculture. Its aim is to explore some of the underlying social mechanisms at play in these collaborative networks. Network perspectives have been used extensively to model the linear diffusion of knowledge from universities to farmers and between farmers themselves. However, bottom-up innovation projects with stakeholders do not only require knowledge transfer, but also need to change the organisational structures, laws and institutions governing the sector.

This thesis consists of two main parts. The first part of this thesis addresses the content of the concept of sustainable agriculture. It conceptualises innovation as a social learning process in which participants forge new relationships to enhance information flows and learn from each other. The results can thus be divided into ‘outputs’ and ‘outcomes’. Outputs are the plans, scenarios, computer models and indicators that form the physical results of a collaborative process. The outcomes are formed by the building of trust and the development of a new discourse, a new shared language with which to communicate with each other. Using discourse analysis and Q-methodology the existing rurality discourses in the Netherlands

were compared to the discourses that were present in the number of innovation projects dealing with sustainable agriculture. Results show that discourses of sustainable agriculture are a natural continuation of existing rurality discourses. The use of technology and the agricultural production function of rural landscapes are among the two most contested elements within the discourses. They are either anti-technological focusing on a multi-functional use of the countryside, or technophile with a strong sense of entitlement of agrarian production in the countryside. Both these extremes are limiting the possibilities for innovative projects to become successful. This thesis defines the concept of Metropolitan Agriculture as a form of sustainable agriculture that combines a technological approach of agriculture on the one hand with a multifunctional use of the countryside.

The second part of the thesis elaborates a new network perspective that links three network functions in innovation systems to individual skills of knowledge creation, institutional entrepreneurship and innovation brokerage. These functions are necessary for the up- and outscaling of a local innovation. Social Network Analysis was used to study the distribution of these three functions over the participants of a collaborative innovation network. Results showed that these three functions are concentrated in three small core-groups and that these core-groups only displayed a very limited overlap. To what extent people are capable to perform one of these three functions depends for a large part on the type of organisation they work for.

Finally, this thesis presents a new mapping technique to investigate and explain the network dynamics of a collaborative innovation network. Using this technique a longitudinal two-mode affiliation network was constructed over a period of 16 years. The analysis of the network dynamics shows how the structural characteristics of size, composition, connectedness and centralisation of a collaborative network change and how these changes are the result of the social relations between actors at the project level as they choose their partners to cooperate with and enter a process of social learning. This thesis therefore shows how the macro-level network dynamics can be explained by micro-level niche processes. It shows how the ideas in the niche change over time with new actors entering the network and other ones leaving after a certain period.

The two parts of the thesis together explain how collaboration processes at the niche level can only gradually change societal discourses. In order to ‘sell’ a new idea it has to be embedded within familiar discourse elements. At the same time, these ideas play an important role in finding new partners to collaborate with and expand the existing innovation network.

# Samenvatting

De stijgende ingewikkeldheid van de moderne maatschappij heeft geleid tot groeiende aandacht voor een specifiek type van duurzaamheidsproblemen die als ‘complexe problemen’ bekend zijn geworden. Deze problemen worden gekenmerkt door hun mix van cognitieve complexiteit (en de daaraan gekoppelde fundamentele onzekerheid), hun normatieve complexiteit die volledig verschillende interpretaties toestaat (voortkomende uit verschillende wereldbeelden) en tenslotte de aanwezigheid van conflicterende belangen tussen verschillende actoren.

Duurzame landbouw is een goed voorbeeld. Het Nederlandse platteland bevindt zich op de drempel van een belangrijke transitie. De ontwikkeling van het platteland in Nederland impliceert tegenwoordig veel meer dan enkel het herstructureren van de landbouwproductie. Het lineaire perspectief op innovatieprocessen waar nieuwe kennis bij universiteiten werd ontdekt en later werd overgebracht naar landbouwers door middel van voorlichtingsdiensten heeft plaatsgemaakt voor een nieuw perspectief op innovatie. Dit perspectief gaat uit van een relationele kijk op innovatie waarbij kennis en innovaties worden gecreëerd samen met *stakeholders* en waarin tegelijkertijd het belang wordt benadrukt van experimenteren en sociaal leren in een netwerk waarin meerdere sectoren vertegenwoordigd zijn: wetenschap, ondernemingen, overheidsagentschappen en non-gouvernementele organisaties. Het doel van deze samenwerkingsverbanden is het bijdragen aan de zogenaamde transitie naar een duurzame landbouw: een radicale en structurele verandering van het landbouwsysteem als geheel.

Dit proefschrift concentreert zich op dit soort innovatienetwerken in de context van duurzame landbouw. Het doel is om enkele onderliggende sociale mechanismen te onderzoeken die spelen in deze innovatienetwerken. Netwerkbenaderingen zijn al veel vaker gebruikt om de lineaire verspreiding van kennis van universiteiten aan landbouwers en tussen landbouwers onderling te modelleren. Nochtans, vereisen bottom-up innovatieprogramma's met stakeholders niet alleen kennisoverdracht, maar ook kennisco-creatie en hierbij zijn ‘institutioneel ondernemerschap’ en de aanwezigheid van innovatiemakelaars noodzakelijk om niet alleen bestaande praktijken te veranderen maar ook om de organisatorische structuren, de wetten en instituties, ‘de regels van het spel’ blijvend te veranderen. Dit vereist een nieuw perspectief op de sociale processen binnen dit soort samenwerkingsnetwerken.

Dit proefschrift bestaat uit twee delen. Het eerste deel richt zich op de inhoud van het concept duurzame landbouw. Het conceptualiseert innovatie als een sociaal leerproces waarin de deelnemers nieuwe verhoudingen smeden om informatiestromen te verbeteren en van elkaar te leren. De resultaten van dergelijke processen kunnen worden verdeeld in de tastbare opbrengsten en de sociale uitkomsten: *'outputs' en 'outcomes'*. Typische opbrengsten zijn de plannen, de scenario's, de computermodellen en de indicatoren die de fysieke resultaten vormen van een participatief proces. Daarnaast bestaan de sociale uitkomsten uit de veranderde verhoudingen tussen de deelnemers in de vorm van een verbetering van de onderlinge verhoudingen en een toename van vertrouwen en sociaal kapitaal. Dientengevolge zullen de *stakeholders* ook een nieuw *discours* ontwikkelen, een gedeelde taal om met elkaar te communiceren. Gebruikmakend van discoursanalyse en Q-methodologie werden de bestaande discoursen over landbouw en platteland in Nederland vergeleken met de discoursen die aanwezig waren in een aantal innovatieprojecten met als doel een duurzame(re) landbouw. De resultaten tonen aan dat de discoursen over duurzame landbouw een natuurlijke voortzetting zijn van reeds bestaande discoursen over landbouw en platteland. De rol van technologie en de landbouwproductiefunctie van landelijke gebieden zijn de twee meest betwiste elementen binnen de verschillende discoursen. De gevonden perspectieven in de innovatieprojecten zijn aan de ene kant sterk antitechnologisch en gericht op een multifunctioneel gebruik van het platteland of juist positief over technologie met een sterke voorkeur voor een monofunctioneel platteland gericht op agrarische productie. Beide uitersten beperken echter de mogelijkheden voor innovatieve projecten om succesvol te worden. Dit proefschrift laat zien hoe het concept metropolitane landbouw kan worden gedefinieerd als een vorm van ecologische modernisering waarbij duurzame landbouw bestaat uit de combinatie van een technologische benadering van landbouwproblemen aan de ene kant met een multifunctioneel gebruik van het platteland aan de andere kant.

In het tweede deel van het proefschrift wordt een nieuw netwerkperspectief uitgewerkt dat drie netwerkfuncties binnen innovatiesystemen verbindt aan individuele vaardigheden van kennisontwikkeling, institutioneel ondernemerschap en innovatiemakelaardij. Deze functies zijn noodzakelijk om een nieuwe innovatie van een zogeheten socio-technische niche, een kleinschalig lokaal netwerk, te laten doorbreken naar een bredere toepassing op hogere schaalniveaus. *Social Network Analysis* werd gebruikt om de verdeling van deze drie functies over de deelnemers van een langlopend innovatienetwerk te bestuderen. De resultaten toonden aan dat deze drie functies in drie kleine kerngroepen zijn geconcentreerd en dat deze kerngroepen slechts een zeer beperkte mate van overlap kennen. In hoeverre mensen in staat zijn om een van deze drie netwerkfuncties te vervullen blijkt sterk afhankelijk te zijn van het soort organisatie waar ze voor werken.

Tot slot introduceert dit proefschrift een nieuwe techniek om de netwerkdynamica van een innovatienetwerk te onderzoeken en te verklaren. Gebruikmakend van deze techniek werd een longitudinale studie verricht naar de veranderingen in een groeiend innovatienetwerk over een periode van 16 jaar. De analyse van de netwerkdynamica toont hoe de structurele kenmerken als grootte, samenstelling, cohesie en centralisatie van een samenwerkingsnetwerk veranderen en hoe deze veranderingen het resultaat zijn van de sociale relaties tussen actoren op het projectniveau en hun keuzes voor bepaalde partners om mee samen te werken. Dit proefschrift toont daarmee aan hoe de netwerkdynamica op macroniveau kan worden verklaard door ontwikkelingen op het microniveau. Het toont hoe de ideeën en experimenten die in een niche worden uitgeprobeerd veranderen met als actoren in het netwerk worden opgenomen of juist vertrekken.

De twee delen van het proefschrift verklaren samen hoe samenwerkingsprocessen op het nicheniveau bestaande maatschappelijke discoursen slechts geleidelijk kunnen veranderen. Een radicaal nieuw idee moet ‘verkocht’ worden door het op te nemen binnen een raamwerk van vertrouwde discourselementen. Tegelijkertijd spelen deze nieuwe radicale ideeën een belangrijke rol in het vinden van nieuwe partners om mee samen te werken en het bestaande netwerk uit te breiden.

# Acknowledgements

Writing this final chapter of my thesis it is difficult not to start contemplating some of the events of the last couple of years. The experience of being a PhD student: setting up my own research, gathering and analysing data and writing different papers was a learning experience that, like many worthwhile experiences, had its ups and downs.

To describe this experience I find it easiest to borrow someone else's words. Tim Parks wrote a preface for his book Italian Neighbours[5], that includes a wry description of a *'busy but inexpert fellow, dashing about the narrow confines of his territory'*. It doesn't take much imagination to recognise a PhD student in him as '*he is waving a net on the end of a long stick'*:

> *"It's not a butterfly net, by the looks of it. It's altogether too big for that, huge in fact. But it might be a will-o'-the-wisp net. Which would explain the extremely fine silk mesh, the random way it is being waved. And if we were to ask this frantic fellow what particular species of will-o'-the-wisp he is after? He stops, out of breath, surprised at our interest.*

This is of course the moment that most PhD students dread: having to explain the intricacies of your research to an innocent bystander. In my case: the different views of sustainable agriculture, how people learn in social networks and how these networks change their characteristics under the influence of new people entering and other people leaving. Something like that.

> *"And how is he getting on? He shrugs, pouts, as if to say, this is a mug's game if there ever was one. Will-o'-the-wisps – you know – the thing is, even when you do catch one for a moment you have a terrible job recognising them, and then when you pin them on the pages of your book they immediately lose all colour and shape. Anyway he is spending most of his time picking truisms, clichés and caricatures out of his net. Not to mention the mere grit and chaff the air is full of."*

This isn't a particular happy description of the research process and it might easily lead readers to think that I myself am not too impressed by my own results.

---

[5] Tim Parks, "Italian Neighbours; An Englishman in Verona", Vintage, London 2001.

However this is not the message that I would like to convey. Of course there have been moments when I could easily identify with this strange fellow, wondering myself whether my results actually meant something and if so what. What is important is to get some encouragements and help from other people along the way to help you with this struggle.

Therefore the first word of thanks is to my supervisors: Tom, Kasper and Hans. Hans, thank you for giving me the final push I needed to start up a PhD project. Tom thank you for your enthusiasm and curiosity in other scientific fields. You always were convinced of the value of my work, even during the periods I was not. Finally Kasper, thank you for your work as day-to-day supervisor. I have really appreciated our collaboration and your accessibility. You were always willing to make time, often on short notice, to discuss a result or help solve a problem. A special thanks to PJ. Even though you were not an official supervisor, I always enjoyed our discussions and considered you a very valuable addition to the team. In the same category I want to thank Luuk for making time to discuss my work on several occasions. I always benefited a lot from our discussions, even if you might not recognise much of your input in the end result.

I am grateful to the people of TransForum, first of all for their financial contribution that made this research possible, but I would also like to thank the participants of the TransForum innovation projects who took the time to complete the online Q-sort. A word of thanks to my (other) co-authors Ina and Marian, thank you for sharing your data and your subsequent input in the papers.

Juggling two jobs in Wageningen and Tilburg was not always easy. What made it significantly easier, however, was that at both places I had some very nice colleagues that made working there very enjoyable. First of all I want to thank my three roommates. Not only for sharing the ups and downs of academic life, but also a lot of personal stuff. Joost and Dirk, thank you for all the interesting and entertaining discussions we had. I can't imagine a couple of roommates who would be able to cover such a wide range of topics. Ruben thank you for putting all these scientific efforts in their right perspective and your practical support in the last months: letting me benefit from your vast experience of having a six months older baby. The same goes for all the other colleagues at Telos: Mieke, John, Han, Corné, Nara, Suzanna, Marleen, Bastiaan, Jules, Wim and Wim. Thank you all for your support and interest, especially during that last difficult couple of months. Thanks also to the staff and other PhD's at the Land Dynamics Group in Wageningen, it was always a lot of fun to share the latest gossip during coffee breaks and lunch. A special thanks to fellow 'soft boy' Mathijs for doing most of the organising of our discussion group on stakeholder participation. Also a warm thanks to the participants, but especially the organising committee of the Kenya

course: Jantine, Derek, Wouter, Monique and Claudius. This trip was absolutely one of the highlights of my time at LAD.

Finally I want to thank my family: my parents, brother and sister for their interest, help and support. Thanks also to my friends who showed me there is a life outside academia. I intend play some more board games and attend some more sailing weekends and drink some beers with all of you in the near future.

Finally a word of thanks to that special female colleague. Kathleen, thank you for your support, trust and humour over the last couple of years. Coming to Wageningen was one of the best decisions of my life because it brought you into it.

# About the Author

## Curriculum Vitae

Frans Hermans was born on the 2nd of October 1973 in Leidschendam, the Netherlands. Growing up in Zoetermeer he received his pre-university education at Erasmus College where he graduated in 1992.

He went on to study Technology and Society at the Eindhoven University of Technology, specialising in environmental engineering for developing countries. During this time he did a four month internship at the Technical University of Crete on the solar detoxification of groundwater. In 1998 he finished his M.Sc. degree in international development studies with a thesis on wastewater sources in and around Bais City, the Philippines. After his graduation he joined the Centre Technology for Sustainable Development at the same university where he worked for six years as a university lecturer. During this time, he was posted for two days a week at Telos, the Brabant Centre for Sustainable Development of the Tilburg University as a junior researcher. In 2005 he joined Telos full time and in 2006 he was editor of the Sustainable Balance Sheet of Brabant 2006.

It was during his time at Telos that his got interested in the issues of stakeholder participation and social learning as opportunities to solve complex societal problems and in January 2007 he started his PhD project on the same topic, working three days a week at the Land Dynamics Group of Wageningen University and two days a week at Telos.

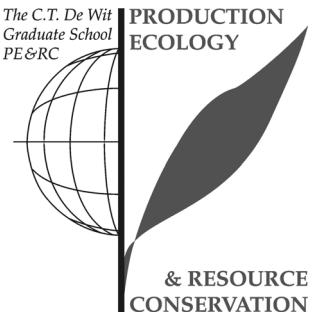
Currently Frans Hermans is living in Wageningen together with his girlfriend with whom he has a daughter. Since February 2011, he is working at the Communication and Innovation Studies Group of Wageningen University on the European FP7 project SOLINSA –Support of Learning Innovation Networks for Sustainable Agriculture.

## Peer reviewed publications

- Hermans, Frans, Dirk van Apeldoorn, Marian Stuiver and Kasper Kok, "Niches and Networks: explaining network evolution through niche formation processes", Research Policy (under review).
- Hermans, Frans, Marian Stuiver, P.J. Beers and Kasper Kok, "The distribution of roles and functions for networking in agricultural innovation systems; a social network analysis", Agricultural Systems (under review).
- Hermans, Frans, Kasper Kok, P.J. Beers and Tom Veldkamp, "Assessing sustainability perspectives in rural innovation projects using Q-methodology", Sociologia Ruralis, (in press).
- Hermans, Frans, Wim Haarmann and John Dagevos, "Evaluation of Stakeholder Participation in Monitoring Regional Sustainable Development", Regional Environmental Change, online first 29 March 2011.
- Beers, P.J., Tom Veldkamp, Frans Hermans, Dirk van Apeldoorn, Joost M. Vervoort and Kasper Kok, "Future sustainability and images", Futures, vol. 72 (7), September 2010, 723-732.
- Hermans, Frans, Ina Horlings, P.J. Beers, and Hans Mommaas, "The contested redefinition of a sustainable countryside: Revisiting Frouws' rurality discourses", Sociologia Ruralis, 2009, 50 (1), 46-63.
- Knippenberg, Luuk, Wim Haarmann, Frans Hermans, Theo Beckers, John Dagevos en Imre Overeem, "Developing Tools for the Assessment of Sustainable Development in the Province of Brabant, The Netherlands", In: Sustainability Indicators: A Scientific Assessment, Tomas Hak, Bedrich Moldan, Arthur Lyon Dahl (eds.), SCOPE nr. 67, Island Press, 2007.
- Hermans, Frans and Luuk Knippenberg, "A principle-based approach for the assessment of sustainable development", Journal of Environmental Assessment, Policy and Management, 8 (3), September 2006, 299-319.

## PE&RC PhD Education Certificate

With the educational activities listed below the PhD candidate has complied with the educational requirements set by the C.T. de Wit Graduate School for Production Ecology and Resource Conservation (PE&RC) which comprises of a minimum total of 32 ECTS (= 22 weeks of activities)




**Review of literature (6 ECTS)**

- Participation for resilience in agro-ecological systems

**Writing of project proposal (4.5 ECTS)**

- The limits to social learning for adaptive capacity in Dutch agro-ecological systems

**Post-graduate courses (6 ECTS)**

- Complexity in and between social and ecosystems; CERES (2007)
- Workshop: computational and mathematical approaches to societal transitions; DRIFT / Lorentzcenter, Leiden (2007)
- Scenario development: understanding and applying multi-scale and participatory concepts and tools; PE&RC Graduate School, Wageningen UR (2007)
- Land dynamics, getting to the bottom of Mount Kenya: analysis of land dynamics and sustainable development in an interdisciplinary perspective; PE&RC Graduate school, Wageningen UR (2009)

**Invited review of (unpublished) journal (1 ECTS)**

- Land Use Planning: how “insiders” struggle with including new actors, new topics and new interaction rules (2008)

**Deficiency, refresh, brush-up courses (1.5 ECTS)**

- Introduction to individual- and Agent-based Modelling; TU Dresden, Germany (2007)
- Introduction to R for statistical analysis; PE&RC Graduate school, Wageningen (2008)

**Competence strengthening / skills courses (1.5 ECTS)**

- Mobilising your-scientific-network; WGS (2009)
- Persoonlijke effectiviteit; Universiteit Tilburg

**PE&RC Annual meetings, seminars and the PE&RC weekend (1.2 ECTS)**

- PE&RC Introduction weekend (2007)
- PE&RC Day: "Expect the Unexpected"(2008)

**Discussion groups / local seminars / other scientific meetings (5.4 ECTS)**

- Set-up, organisation and participation in the PhD discussion group "stakeholder participation in scientific research"; PE&RC Graduate School (2007-2010)
- Poster presentation: "applying Q-methodology to find images of sustainable agriculture"; TransForum day (2009)
- Twice a year a presentation for the Telos research seminars (2007-2010)

**International symposia, workshops and conferences (6 ECTS)**

- Paper presented at the 8$^{th}$ International Conference of the Russian Society for Ecological economics: economic development and the environment: strategies, models and management tools; Sochia, Russia (2007)
- "Speed talk" given at Resilience 2008: resilience, adaption and transformation in turbulent times, International Science and policy conference; Stockholm, Sweden (2008)
- Paper presented at the First European Conference on Sustainability Transitions "Dynamics and governance of transitions to sustainability"; Amsterdam, the Netherlands (2009)

This research has received funding from TransForum, and was carried out as part of TransForum's Scientific Programme on Images of Sustainable Development.

Cover design and printing: Print Service Ede