Innovativeness of innovation

A study on the effects of social institutions on innovation practices in the Westland horticulture sector

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MSc Thesis for Industrial Ecology, by Noortje Schrauwen, at the Energy and Industry section of the Technology, Policy and Management Faculty of the TU Delft.

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Summary

The horticulture sector in the Netherlands is facing economic difficulties, which have become more severe since the crisis of 2008. The innovation strategies the growers select to stimulate their organizations, are identified as part of the problem. The dominant presence of some innovation strategies, mainly cost-reducing and volume-increasing strategies, bring down the cost price of products, but fail to bring the organizations prolonged benefits. Due to mechanisms in the market, the financial benefits are of short duration: the product prices drop when the innovation spreads quickly in the sector and the organizations sell their products for even lower prices as a result of the fierce price competition central to 'cost leadership' segments. Other innovation strategies, aimed at increasing the value of products or extending the activities are less popular in the sector, despite their potential to counteract the downward spiraling prices.

This thesis explores the innovation practices in the Westland horticulture sector to obtain an understanding on how these patterns in innovation emerge and are maintained. It shows how the dominant use of cost-reducing and volume-increase innovations can be explained from a social perspective. Is it therefore not the innovation itself that is studied, but the innovation *practice* of growers. Insights are provided on the ways growers innovate, how they make decisions, deal with institutions (rules, norms and shared strategies) and come to an investment. The hypothesis supporting this approach is that the organizations and innovation practices are socially embedded, and can be studies as such.

The central subject of this study is the effects social institutions have on innovation practices in the Westland. To study this relation between the institutions and individuals, the bathtub model of Coleman on social action is used. The model provides in this thesis the frame to study innovation practices at the interaction of macro-level (system) and micro-level (individual), addressing the questions 'how social institutions affect individual growers?', 'how do individuals assimilate institutional power when deciding on investments?', and 'how can system-level patterns and dynamics be explained as the emergent result of actions and interactions of individuals?' Ethnographic fieldwork was used to obtain an understanding on innovation in the sector. The use of participatory observation, interviews and group discussions provided insights on innovation practices, producing a rich body of data on the actors studied. The use of ethnography has the special benefit of gaining an inside-perspective in the sector, studying both patterns in practices, as well as variation and exceptions amongst growers. Explanations on social action are based on social mechanisms, clarifying patterns in the data with existing theory, which is called 'grounded theory' in social science. The set-up of the methodologies suits the exploratory approach of this research on social institutions and innovation practices in the sector, placing innovation in the horticulture sector in a new daylight. A second objective was to complete the analysis so that the results can be used to underpin an agent-based model of grower society and horticulture ecosystem development. The MAIA model is used for this purpose, using its metamodel to describe the system.

The study on institutions revealed that several formal institutions and informal institutions support innovation practices based on cost-reduction and volume-increase, providing thereby social explanations on the dominance of those innovation strategies. Several important organizations were identified, being the bank, the EU, the municipality, LTO Glaskracht, and sales organizations. The exploration on the impact of the formal institutions involving horticulture organizations (as contracts, regulations and official agreements) revealed that the set of institutions have a substantial impact on the type of innovations used.

The regulations of the NMA forbids production and price agreements, thereby creating barriers for the grower community to develop self-organizing mechanisms to counteract the supply chain imbalances and harmful low prices. The prohibition to develop joined strategies, makes it hard for growers to jointly address price fluctuations and supply chain issues; the institutions stimulate the fierce competition on cost prices of horticulture organizations instead. The regulations of the municipality do not prioritize innovation strategies, but do prescribe regulations on safety, environment, energy and water use, etc. These regulations are in general aimed at the physical greenhouse, prescribing adaptations to the processes of greenhouses. Growers may have to spend their money to comply with (new) regulations, leaving less for other purposes, as marketing and product-extension.

Some other formal institutions are written in contracts, as in the case of a loan from the bank or GMO subsidy from the EU. The study showed that growers are trading off options, in which the availability of financial means is a central element. A grower may: a) not apply for finances, thereby staying free from those contracts, or b) apply for finances - having more financial means, but agreeing to rules stated by the organization. Either of these decisions may have a huge impact, as even the smallest differences between organizations and in cost prices may distinguish an organization's success from failure. The pressure resulting from the fierce competition on cost price intensifies the power these institutions have on them. In the case of GMO, a grower receives the subsidy when he invests in a (mainly physical) novelty, accepting that he has to sell via one of the larger sales cooperations, abandoning all individual marketing strategies. In the case of the bank, loans are only given for assets, that function as premises to the bank in case the organization cannot pay back the loan. LTO Glaskracht acknowledges the need for marketing, but since the organization is a union, the wish of the mass is taken as the input for lobbying activities. This means in practice, that the message may be quite conservative – or at least not explicitly supporting the innovative frontrunners. An important finding in the study, is that many actors and organizations recognize the problems as identified in this thesis, but at the same time, support the social institutions prioritizing process-aimed investments. Efforts to stimulate marketing and other non-process innovations are taken, but often as a side-projects, rather than reconsidering the more central institutions of organizations that are of large influence.

After, the stories of five growers were used to explore innovation practices on individual level, providing more insights in the decision making processes. The stories show the variety of actors and strategies in the sector, by illustrating quite different organizations, growers and strategies. The ethnographic descriptions gave insights on the people involved in the greenhouses and innovation practices, portraying realistic actors. The study showed how choices are dependent on the personal believes, shared norms and strategies, incidents, and values of growers, and the way they deal with social institutions. The sections of the growers active in bulk products using mainly process-innovations, showed how their activities are supported by informal as well as formal institutions. In contrast, the growers managing greenhouses based on differentiation strategies, have to overcome more institutional difficulties. It tells us that the innovation practices are socially embedded, and in order to change innovation practices, growers have to deal with or overcome both formal as informal social institutions. Stated differently, new innovation practices based on value-increasing and activity-extending strategies, requires some level of social innovation, as new ideas, norms, practices and believes should be adopted – as the institutional contacts in general supports process-aimed innovation. The five stories showed how inviduals deal with these structures and arrive at investment decisions; some conform the norms and some displaying innovative ideas and actions. These activities were used in the the succeeding chapter to explain system phenomena.

Three system dynamics identified as problematic were discussed: the process of homogenization of organizations, the occurrence of overproduction, the spiral of decreasing product values of bulk crops.

With the use of transformative mechanisms, the emergence of the system phenomena from individual actions and interactions could be illuminated. The study showed that actions of individual growers are rational from their perspective, but altogether give rise to system patterns that are undesirable for all. The five categories of social errors (*Immediate interest, Errors and self-defeating prophecy*, *Basic values* and *Ignorance*) as discussed by Merton provided explanations on the occurrence of unintended outcomes of rational actors aiming for success. This provides us an insight on how system level problems can be understood, taking inividual action as the subject of study. Chapter seven showed that short-term benefits may override long-term benefits, as short-term requirements seem more urgent and are easier to understand and calculate, creating the error of *immediate interest*. The explanation of the *error*, implying the *´incorrect analysis of the problem or following habits that worked in the past but may not apply to the current situation'* relates well to the deeply embedded routines of growers to focus on production issues, not dealing with market concerns nowadays. The inability to set a higher price level without a self-governing mechanisms may lie in the tragedy of the commons, which is often defined as '*the dilemma arising from the situation in which multiple individuals, acting independently and rationally consulting their own self-interest, will ultimately deplete a shared limited resource, even when it is clear that it is not in anyone's long-term interest for this to happen'*. The social mechanism in the tragedy of the commons does give a good explanation on the actions of individuals: the individuals are pursuing their own interest, following their independent rationality of their situation, altogether causing issues as macro level, as the increasingly lowering of product prices.

Taking the just discussed approach, this thesis relates to several fields of science. First, it continued the 'structure-agency' debate, central to sociology, addressing the effects social institutions have on individuals. The Coleman bathtub model allowed to study the power that institutions have on people, as well as gives includes the freedom of individual choice. This study had the aim to present a balanced perspective on innovation practices in which both the individual as structures in the sector are included. Second, it addressed the social embedding of organizations, acknowledging the individuals actors and their decisions. This perspective on industries is relevant for the field of Industrial Ecology, as it reveals the social workings supporting organizations, materials flows, energy use and emissions. And third, it provided insights for the fields of cultural anthropology and modeling on how the methodologies of ethnographic fieldwork and agent-based modeling may be jointly used in a research project.

A suggestion for further research is to take a closer look at the formal social institutions in the sector, and explore ways to improve the 'rules of the game' for innovation practices and sustainability improvements. Especially the social institutions observed by the EU (GMO subsidy) and the regulations by the NMA may provide an interesting subject, as their impact was described as very high in this study. A second suggestion for further research is on the effects of sustainability activities in perishable bulk products, as most crops in the horticulture sector. The issue seems to lie in that activities improving the efficiency of processes, and therewith reducing the environmental impact of products, do not increase the value of products, but rather reduces it. The mechanisms that are at work in agricultural sectors and cost-leadership segments, have the effect that the costs reduction through efficiency improvements lead automatically to lower prices. The more efficient produces products are worth less. Perhaps new marking innovations or supply chain adaptations may contribute to this matter. The last recommendation is to finalize the agent-based-model, after which it may be used to study the system dynamics. In specific, the comparison of the outcomes of the outcomes of the model and the social analysis on transformative mechanisms may be compares, studying the emergence of system phenomena with different methodologies. Further insights could be obtained on the combined use of ethnography and agent-based modeling.

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1 Introduction

"*I have traveled quite a lot in my life, and I can say with certainty that we have all the technological development we need. We are absolutely number one when it comes to technological innovation. The issue nowadays is that we need to change in different ways, changing the sector and supply-chain structure. I must say the mindset of growers is a major barrier to this*" (Interview with Jos Looije, June 2012).

The quote of the grower illustrates an issue that is currently a main topic of debate in the Dutch horticulture sector: the sector is considered to be the most productive and innovative horticultural cluster in the world, yet – it is facing economic difficulties. The technological innovations have brought the sector its advantageous position, but seem to near the limits of their effectiveness. Not only are the innovations gradually approaching their maximum physical efficiencies, organizations in other countries are also catching up with the Dutch horticulture practices. The strategies that have been very successful seem not to be the solution to the current economic problems – the question that is now posed is what *is*. The issues are widely debated within the sector, but have also become a hot topic outside the sector, being frequently reported on by the media. The developments in the Westland horticulture are an interesting case, not only because it makes up an important part of the Dutch economy; the sector also contains several seemingly contrasts. Its international leading position and innovative successes seem to conflict with the current economic difficulties. Also the family-owned and managed businesses are becoming huge industrialized enterprises, where the technological developments succeed each other quickly while the strongly present cultural heritage seems to evolve in a much slower pace. This coexistence of culture and company, but also technological development and individual preferences, seem to create interesting situations and dynamics and is also central to my motivation to study the innovation practices with a social perspective.

This brings us to the central theme of this thesis; an exploration of the innovation practices in the Westland horticulture sector, thereby getting a grasp of the way innovation really works, what decisions growers take and why, or in other words, what the innovation practices of growers are. Our hypothesis is that growers and their organizations and innovation practices are socially embedded, and can be studied as such. The just described sectorial problems will be studied at the intersection of the individual human being and social institutions in the sector, searching for an understanding on how the innovation practices relate to the indicated problems.

As the grower of the quote explains, perhaps new *ways* of innovation are the key to overcome the current challenges in the sector. Those new ways of innovation open up new possibilities also outside efficiency improvements, but this would require a different strategy, or 'mindset' as the grower states. A study on the technology itself would not suit, as the change in the *practice* of innovation has to do with people, their strategies, routines, believes and norms. It is a social topic rather than a technical one. This viewpoint makes the choices and actions of growers on their innovations and investments the subject of study, rather than the performance of the innovation itself. By taking this perspective, I expect to provide a better understanding of the social embedding of the innovations in the horticulture sector. This has drawn my attention, as it is still the people in the sector who actually run their (family owned) organizations, choose innovations, draw upon their believes, experiences, preferences and values when they act - even now that the horticulture has become a large-scale and high-tech industry.

I expect that my background in anthropology and sociology helps me to take on this social perspective on a sector that is often described as far-industrialized. In the traditional field of cultural anthropology, mainly non-Western and exotic cultural forms were studied. More recently, also human life and its expressions in Western societies is gaining popularity. Still, research on the embedding of industrialized sectors in cultural and social systems is rare in the field of cultural anthropology, which makes it in my eyes a very interesting exercise. It bridges different and before seemingly unrelated fields as cultural anthropology, innovation studies, business strategies and modern economics.

The Westland horticulture sector provides an interesting case for social research, as it both distinguished as a cultural region as it is an economic and industrialized sector. The cluster entails a strong social network that is central for information diffusion and shared innovation practices, and is predominantly made up of companies owned and managed by families who are strongly embedded in social ties in the region. Because of this strong social embedding of organizations and innovation practices in the Westland, a study of innovation practices is expected to provide valuable insights. Insights not only on the social embedding of innovation practices but also on the outcome of these innovation practices: patterns in innovations and the (physical) characteristics of the horticulture organizations.

Following this social view on innovation, it is the *experienced* newness of an innovation practice that is subject of research, rather than the 'objective' newness of a technology or concept. The innovation thus lies in the *social innovation,* which occurs when the adoption of a novelty would implies a new variety in the believes, values, norms and action strategies of growers. Questions that are relevant in this respect are: 'Is the adoption of a novelty in line with the innovation strategies, believes and norms of the growers, or should they overcome their conventional ways of innovating?', and: 'Does the grower innovate in a conventional way or is he exposing new ideas, strategies, or socially innovative behavior?' This characterization of innovation has a major impact on this study, as it determines the focus of the study, which is on perceptions of people, rather than physical innovations as technologies in greenhouses.

1.1 Research questions

The aim of this thesis is to gain a better understanding on the innovation *practices* in the sector, thereby exploring the decisions and actions of growers. As these growers are not independent individuals, but rather actors embedded in a community, business network, and in a system with regulations, subsidies and contracts, the study will not only include the decision making strategies of individuals, but will also include a study on the larger social structures present in the sector, also referred to as 'social institutions'.

Subsequently, the underlying theme -which has formed a central topic of debate in social science - is how individual decision-making and action should be understood and explained through structure and agency. The agency refers to the capacity of individuals to act independently and make free choices, whereas 'structure' or, what I will call social institutions in my thesis, relates to those more enduring social entities which limit or enable actions of individuals. In my study on innovations, I will continue this debate by addressing the influence of social institutions on the innovation practices of individual growers, and question the individual decision making strategies and innovation practices. The main research question that guides this research is:

"How do social institutions affect innovation in the Westland horticulture sector?"

The sub-questions that will be used to answer my main question are stated below. The first sub-question addresses the need for a framework and a set of methodologies to approach the research question with. The answer to it lies in a proposal of a strategy to frame and operationalize the research question.

I. **How can the relation between institutions and innovation practices be studied?**

As the main question is too broad to answer directly, it is divided into sub-questions II to IV. The answers to these questions will provide the explanations on how the social institutions affect innovation practices, drawing upon theory on social mechanisms. The last sub-question (V) questions the potential of modeling the outcomes of the analysis on innovation practice.

II. **Which social institutions are dominant in making innovation decisions?**
III. **How are decision made on innovation practices at the individual level?**
IV. **Can the phenomena on system level be explained by interactions on individual level?**
V. **How can we model the social institutions to understand the effect of institutions on innovations?**

Altogether, these questions will provide insights in the way the research question can be approached and studied, the way social institutions affect innovation practices in the Westland horticulture sector, and the lessons that can be learned from modeling the system of study.

1.2 Research approach

Innovation practices and social institutions are social concepts that are not easily identified 'out there' in the Westland. The first question that rises is how the influence of social institutions on innovations can be studied. In my thesis, I will use three main methodological elements to study the relationship:

First, I will use **ethnographic research** to obtain empirical date on the horticulture sector and the growers specially. In this filed research, I will study innovation practices in the horticulture sector, with a special focus on dominant social institutions related to innovation, personal stories of growers, their decision making criteria, innovation practices, and social relationships. The field of anthropology brings great insights in innovation practices through the empirical method used, called ethnography. Empirical research is crucial to obtain an understanding on real actors, highlighting the variety of actors, personal stories, social behavior, relationships, or in general: the social embedding of companies and innovation practices. The field of anthropology is useful in this sense to obtain a good insight in the cultural and social setting of growers and companies in the Westland

Second, a **qualitative analysis** on the ethnographic findings will provide explanations on how social institutions, individual decisions, innovation practices and system phenomena relate to each other. Sociological theory, mainly on social mechanisms, facilitates the explanations on *how – through which process* – innovation practices and system patterns can be understood. Through these mechanisms patterns and dynamics can be explained.

Third, I will create a model description by **transforming the findings and analysis from the fieldwork into a model description.** I will thereby explore what can be learned from the combined use of ethnography and agent-based modeling. This means that I will make the step from the plural ethnographic data towards an agent-based model description, thereby exploring the possibility to combine the two 'tools' originally used in quite different fields. Ethnography has a strong empirical character, producing data by studying and interacting with real people and systems directly. Agent based modeling produces valuable insights *after* having described the real system in the computer model, proving a simulation model of this real system. The two seem the fit together methodologically as successive steps. Yet, due to their differences in ontological assumptions, methods and methodologies, clashes may be expected too.

1.3 Structure of this thesis

The structure of this thesis corresponds with the sub-questions as introduced before in this introduction, and is divided in three main parts. Each of the three parts start with an introduction and end will short conclusions on the part and chapters in it.

Part I – theoretical and methodological approach. In the first part of my research, which consists of three chapters, I will address the question how the relation between social institutions and innovation practices can be studied. In chapter two, I will further illuminate what the issues are in the horticulture sector, and how I will define and frame the problem I am studying. In the third chapter, previous research efforts on the horticulture sector and theoretical background supporting and guiding my analysis will be elaborated on, concluding on the framework that I will use in my thesis. I will also explain how my research contributes to Industrial Ecology, the scientific field which this thesis is written in. In the fourth chapter, I will explain how I will operationalize my research within this framework into methodological steps. For those interested in the theoretical and methodological approach of the subject, the chapters colored blue are most interesting.

Part II – fieldwork outcomes on innovation practices. The outcomes of the ethnographic fieldwork and social analysis will be discussed in the second part of my thesis, which also consists of three chapters. In chapter five, I will explore the dominant social institutions that embed the current innovation practices in the sector. These social institutions include both formal innovations (regulations, contracts, etc.) as well as social institutions (norms, shared strategies, etc.), and describe how these institutions might affect individuals. In chapter six, I use five stories of growers to illuminate the way they decide on their innovation strategies, deal with these social institutions, but also incorporate own believes, values, and preferences - potentially leading to new innovation practices. This chapter provides a more ethnographic and detailed description on the growers and their personal stories. Patterns and differences are discussed using the individual stories as illustrations. In chapter eight, I will again look at the system level issues as described in the first chapter, providing explanations on the emergence of system level patterns from actions and interactions of individual growers. Altogether, this part will report on the findings of the ethnographic study in the field, using theory to explain the patterns and dynamics found in the data. For those interested in the outcomes of the fieldwork, you may best read the chapters colored green.

Part III – modeling innovation practices. The chapters of the second part provide insights in the innovation practices in the horticulture system. Furthermore, the outcome will form the input of an agent-based model description. The step from the ethnographic data towards a MAIA model description is discussed in chapter eight, working towards two outcomes: First, I will present a model description in the MAIA meta-model, providing the descriptions and evaluations on the codifying process. Second, I will conclude on the lessons learned from the process of creating a social system description in the MAIA meta-model. This third part colored red addresses the modeling topic, and can be best read by those interested in this topic.

part I

Defining the research

In this first part, I will addresses the question how the relation between social institutions and innovation practices can be studied. I will answer this question in three chapters. In chapter two, I will further illuminate what the issues there are in the horticulture sector, and how I will define and frame the problem I am studying. In the chapter three, I will introduce the theoretical framework I will use in my thesis. In the chapter four, I will explain how I will operationalize my research within this framework into methodological steps.

Altogether, this first chapter is the preparation for the field research, analysis and modeling, as it defines the research, concluding on a suitable problem definition, framework and methodologies. The outcomes of this part are the guide to my research process.

2 Trouble in the horticulture sector

2.1 Introduction

As briefly discussed in the introduction, the Dutch horticulture sector is currently dealing with some serious economic challenges. Some ascribe the issues to economic crisis that has started in 2008; others see the - for horticulture disadvantageous - Dutch climate the source of all issues, while others ascribe the economic difficulties to the performance of the growers themselves. As the quote in the introduction of the grower touches on: the technological innovations have been exploited quite far, losing its effectiveness. But how did this development come about and why did this create economic issues? In this section, I will further elaborate on the problems the sector is currently facing, and define the problem statement central to my research. This sharpens up the focus of my research in this social system setting, as these settings are typically fuzzy, multifaceted and complex.

In this background section, I will first describe the developments in the horticulture sector since the Second World War, which has eventually led to the current economic challenges faced by the sector. These challenges will be described in more detail, using the work (of Hekkert et al. and Porter to refine the problem statement.

2.2 The developments in the Dutch horticulture sector

The Westland-Oostland Greenport is considered to be the most productive and innovative horticultural industry cluster in the world. The region shares a history of several hundred years of agricultural development and innovation within the sector, with grower families having lived and worked in the region for many generations. This makes the sector very tightly integrated in terms of the actor-network and allows for innovations to spread quickly, creating interesting innovation dynamics in the region. The roots of the Dutch market greenhouse system extend back to the 17th century when the auction system for flowers emerged as one of the first modern exchanges for goods and services. Modern horticulture practices in Westland started around 1850 in a coevolution of environmental, technical and social developments.

The greenhouse sector has evolved significantly over the past 50 years, with in-depth changes on the types of products that are cultivated, the use and development of technologies and the network organization (Berkers and Geels, 2011). After the Second World War, the Dutch government introduced a new vision for the horticultural sector, as companies and the economy as a whole had to be restored after the war. At the same time, the European market liberalized, which increased exports and international competition. Rationalization, mechanization and scale enlargement became the new standards for the horticultural sector. The Dutch government stimulated this mechanization by relaxing the system of growing permits, which also allowed horticultural companies to grow. (Berkers and Geels, 2011). The liberalization of the European market and the recovery of the European economies led to tremendous increase in demand. Meanwhile the Netherlands managed to acquire a prominent market share. The welfare increased, as did the labor costs, stimulating the growers to employ technical innovations that could improve the efficiency and costs of production. Technologically, the innovation took a flight in the fifties and sixties when a new type of greenhouse was introduced. The closed and insulated 'Venlo type' would open the way for many new innovations as artificial light, watering, CO2 use, and artificial heating. Tied to these technological and scale developments, horticulture practices shifted from craft-based farming to mechanized, large-scale farming (Berkers and Geels, 2011).

Later on, in the sixties and seventies the demand shifted from heavy bulk products towards higher quality and more sophisticated products. For growers an adjustment to change from quantity-aimed production to production with a stronger focus on quality, such as improved taste and nutrition, was needed to respond to these changes in demand. Yet, the development of liberalized bulk markets kept cost-reductions an important focus, as did the continued stimuli by the government to rationalize, mechanize and increase scale, thereby stimulating the technological innovation in the sector.

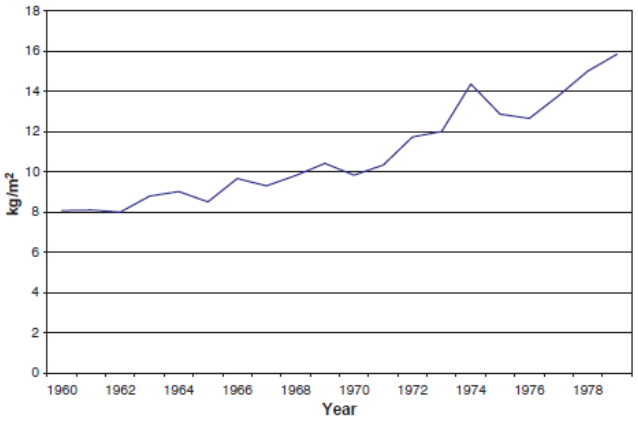

Figure 2 - Tomato yield in km/m3 (Berkens et al, 2011)

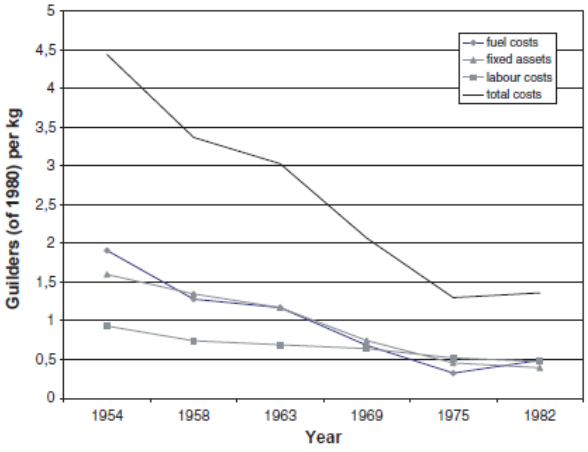

Figure 1 - Production costs per Kg (Berkens et al, 2011)

Moreover, the tight cooperation with universities and other research institutes brought the innovation a step further, enabling technological solutions that could not have been developed within the grower community. Innovation in the horticulture sector was taken on as a joined cause between growers, research institutes and the government. The cooperative character of the sector, in study groups and grower cooperations, together with **the** close cooperation with research institutions and universities, gave the sector a strong network for innovation. Together, the sector of greenhouse farming made a favorable innovation system, resulting in steep production increases.

The success and strong position of the Dutch sector in the global market can to a great extend be ascribed to these unique and strong innovation system and cooperations. The innovative character resulting from the cooperation described above has enabled the Dutch horticulture sector to overcome its less favorable position compared to competing horticulture regions such as Spain, Italy and Israel. The advanced technical position has helped the Dutch growers to overcome competitive disadvantages such as lower temperatures, little sun-hours, higher wages, expensive land prices and historically stricter regulations. The increased international competition due to globalization and market liberalization has stimulated the Dutch horticulture sector to improve its process efficiency to overcome their backlog. The production yields per square meter have increased steadily, while the cost-price per kg of products decreased, as can be seen in the example of tomatoes in the two figures, taken from Berkels and Geels (2011). The major performance increases in the Dutch horticulture sector has made the sector a competitive player in the cost-price driven and globalized fruit and flower market.

The globalization and market liberalization has also increased the international competition from other horticulture regions, which has stimulated the Dutch horticulture sector even more to continuously improve its process efficiency to overcome their backlog. As a result the production yields per square meter have increased steadily, while the cost-price per kg of products decreased, as can be seen in the example of tomatoes in the two figures, taken from Berkels and Geels (2011). The major performance increases in the Dutch horticulture sector has made the sector a competitive player in the cost-price driven and globalized fruit and flower market.

2.3 Current challenges

So which challenges is this sector - with its unique innovation network and high efficiencies - dealing with currently? After the historical challenges and development patterns described above, the sector has come across new challenges in the last two or three decades. The pathway of increased efficiency of production is losing its effectiveness, as the technological innovations are slowly approaching the maximum efficiency, while at the same time innovations are spreading to competing regions. On local level, the auction hall was dissolved, changing power positions in the market. Wholesalers and supermarkets that were previously buying products via the auction hall, would now be able to buy them directly from producers. This has opened up the market for free competition, which had some large impacts. From that moment onwards for example, it would become

possible for large merchandisers to play off grower cooperations against each other, as they had acquired the freedom to collect the different offers and choose the cheapest one.

This has led to fierce cost-price competition. Technological innovation to bring down the cost-price of products grew even more as the central strategy for most organizations, to increase their margins. The current declining effectiveness of this shared strategy of the Dutch horticulture sector poses the major question how the sector can redefine its strategy and competitive position in relation to other sectors.

Besides the declining effectiveness of process-efficiency improvements, the strategies have also led to some other challenges. First, the increased efficiency, productivity and scaling-up of greenhouses has led to higher productions, which in turn led to overproduction as the demand did not rise at the same level. One of the consequences of this market imbalance is that products are being sold on or even under the cost price. This was reinforced by the introduction of regulations prohibiting growers to destroy food products. The effects on sector-level can be found in unhealthy prices and decreasing profits. A second effect of the dominant focus on scale enlargement and production efficiency lies in the *dominance* of the focus. The previously successful process-strategies kept dominancy over other innovation targets, such as marketing or product innovations. Moreover, the typical inward-focus of process innovations is dominant over innovation practices with an outward focus (supply chain, consumer-market, etc.). Growers are therefore less successful in reacting on market incentives, but also in communicating their efforts to consumers, which would help them to position their products and improve the product value.

Currently, the sector faces international competition that is catching up with the innovative character of the Dutch horticulture sector, thereby loosing its privileged position. This development reduces the effectiveness of process innovation, which demands for new innovation strategies outside the well-known process innovations. Stated differently: there seems to be a need for growers to change their innovation strategies, as the conventional process innovations cannot solve the current problems. In the next paragraph I will refine this problem statement with the use of literature of Porter, Hekkert and SIGN defining the strategies of competition supporting innovation strategies (Porter, 1980; Hekkert, 2011; Op de Beek, 2011). This will contribute to a better understanding on innovation practices, as the strategies of competition contain underlying logics, success criteria, and required capabilities of the grower to make the strategy successful. Innovation practices can therefore not seen dependently of the logics of the used strategy of competition.

2.4 Strategies for competition

Hekkert specifies the dominant presence of process innovations in his work, showing that the horticulture sector is in need of more product and marketing innovations to overcome its problems (Hekkert, presentation, 2011). In terms of Porter's famous diagram of competition (Figure3), the dominant *strategy of competition* applied by organizations in the horticulture sector is based on cost leadership strategy (Porter, 1980).

Target/Market Scope	***Advantage***	
	Low Cost	***Product/Service Uniqueness***
Broad (Industry Wide)	Cost Leadership Strategy	Differentiation Strategy
Narrow (Market Segment)	Focus Strategy (low cost)	Focus Strategy (differentiation)

Figure 3 - Porters diagram on competition strategies (Porter, 1980)

The *innovations* in the sector are similarly focused on reducing the cost-price, contributing to the ability of companies to even further compete in their chosen strategy. If we look at Porter's model we have seen that in recent decades the main focus of the Westland horticulture sector has been on cost reduction and volume increases.

If we look at Porter's model we have seen that in recent decades the main focus of the Westland horticulture sector has been on cost reduction and volume increases. The differentiation strategy, which demands for the 'development of a product or service that offers unique attributes that are values by customers and that are perceived of being better of different that the products of competitors', forms rarely the core strategy in horticulture organizations. The two strategies are conflicting in multiple ways. In the case of cost leadership, the profits are made through reduction of the costs and via a larger market share that is obtained by charging lower prices than competitors (Porter, 1980). The products compete on their low prices and are often commodity products. The innovation focus is inward and process aimed; at increasing efficiencies and costs within the organization.

The differentiation strategy is radically different in the sense that the products that are delivered are of higher value. The competition strategies lie in delivering high-quality and attractive products, by adding value in the production and communicate this to consumers to increase the willingness to pay. Competition lies in good marketing, innovations, research enabling an organization to gain a position is niche markets. The focus is therefore lies outside, as it is adaptive to consumer wishes.

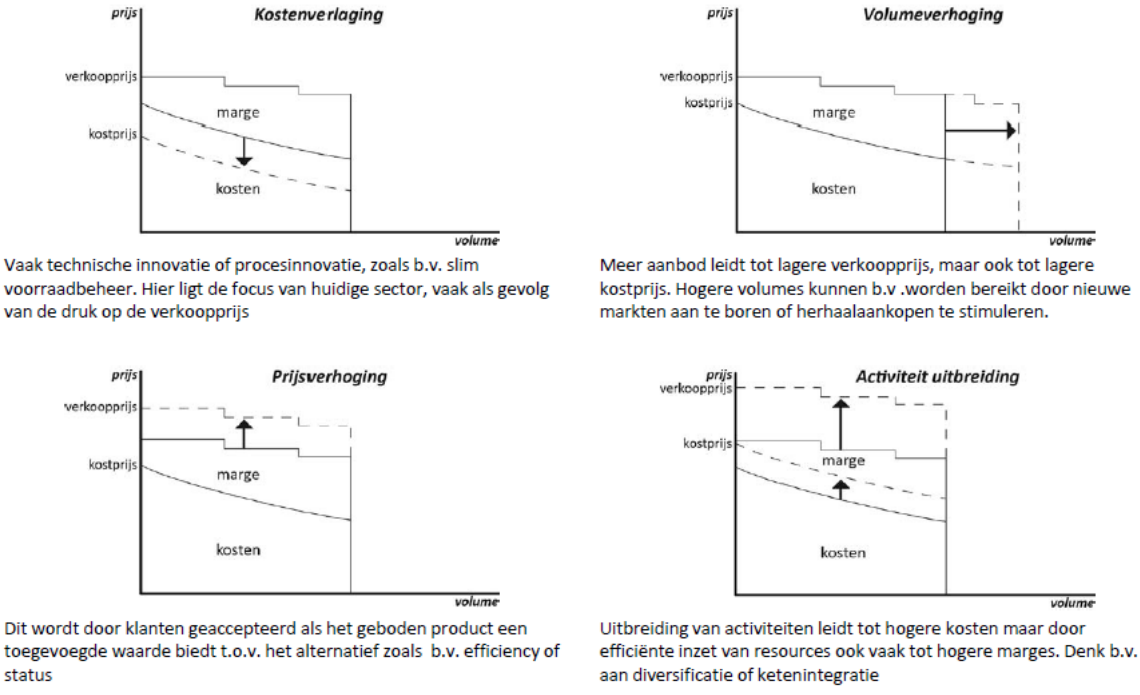

Figure 4 - Four strategies of competition in the horticulture sector (source: SIGN, Marktgericht innoveren, 2011)

The strategies of Porter are the basic economic strategies; however, there are more variations to this. Leon op de Beek in cooperation with the innovation platform SIGN, part of LTO Glaskracht Noord, distinguishes four possible strategies relevant for the horticulture sector, as can be seen in figure four. The upper two strategies, cost reduction and volume increase are both strategies that are of 'cost leader ship' nature, as both cost reduction as volume increase improve the production efficiency and cost price of products. These strategies are dominant in the Westland horticulture sector. The lower two strategies, price increasing and activity extending

are more related to the 'differentiation strategy', as the focus is not merely on cost reduction, but value increase of the products, anticipating on consumer wishes.

The distinction between the strategies is important to this research, as it shows how contrasting the basic strategies of competition - as discussed by Porter - are. Not just in economic sense, but also the in the underlying logic, success criteria, methods, and required capabilities of the grower to make the strategy successful. It subsequently provides insights in the large differences there can be in the related strategies of innovation, and the underlying assumptions. This thesis addresses the social embedding of innovation practices. The acknowledgment that the basic strategies of competition are also socially embedded in the practices, focus and strategies of the growers in their organization it is therefore an important starting point. The strategies as described by Porter and SIGN are instrumental to explain how the strategies, practices and goals of growers are related and perhaps part of the business model of their organization. Also, the identification of a business model is useful to understand the characteristics of an organization, its position and its in- and outputs.

2.5 The social embedding of the sector

The sector's history seems to have developed a strong focus on process optimization for more than a century. As I showed in the previous paragraph, the dominant strategies are embedded at organizational level in the strategy of competition. So far, the focus has been on organizational level by identifying the business model. However, also some first linkages were made to the social embedding of organizations, as the strategies of competition house certain 'believes' on ways to compete, variables of success, practices and goals that are enacted by the growers, thereby being connected to the abilities, expectations and understanding of the growers involved. These believes, measures of success and strategies incorporated and enacted by the growers will be further studied in part II of this thesis.

However, the dominance of innovation strategies can also be embedded at a sector level. Over time, the sector structures may have been shaped around efficiency increases, scale enlargement and cost-price competition. Examples of these structures are institutions as regulations, contracts, network structures, and supply chains. The institutions in the sector may be directed towards the dominant strategy of 'cost leadership' and may thereby create a 'lock-in' which may restrain organizations to take on new strategies. In part II of this thesis, this social embedding of organizations will be further studied, focusing both on system wide institutions, as well on individual level. The implication of the social embedding of innovation practices forms the core of this thesis.

2.6 Conclusion

In this chapter, I have explained in more detail what the sectorial issues are, positioning the problem statement in preparation for my research. The issue I will address in my thesis is the dominant presence of some innovation strategies over others, which are closely tied to the underlying strategies of competition. I will study this pattern by addressing the influence of social institutions over the innovation practices.

Using the work of Porter, Hekkert and a report by SIGN et al was used to define the problem statement in terms of organizational strategies central to horticulture business models (Hekkert, 2011; SIGN, 2011). The four strategies of competition that will be used in this thesis to understand the main differences in organizations and strategies, are: cost-reduction, volume-increase, activity-extending and value-adding strategies, of which the former two are 'cost leadership strategies' and the latter two are 'differentiation strategies' as categorized by Porter. These strategies of competition are not only important to understand how the horticulture organizations have contributed to the economic issues in the sector, but it also addresses the social embedding of organization as it provides insights in the underlying logics, strategies, criteria for success, focus and acquired activities of horticulture organizations.

In this chapter, I have discussed the sector challenges, which entail economic problems and are connected to business strategies. It is however *social embedding* of these organizations and practices that forms the focus of my research, thereby producing a social perspective on the sector issues. The underlying proposition is that the organizations and innovation practices are socially embedded, which means that the innovation activities are embedded in a sector structure, in organizations, people's routines, strategies, believes and in skills of employees. Having clarified the problems in the sector a bit more, the question arises how I can study the social embedding of these growers and their organizations, and ultimately, how 'the social institutions influence innovation practices' in the sector.

I will therefore in the next chapter explore how I can approach the subject of this thesis. I will discuss previous research and provide relevant background theory to in the end of the chapter, conclude on the most useful framework for my thesis.

3 Theoretical background

3.1 Introduction

In the previous chapter, I have discussed the historical and current challenges in the horticulture sector, and how these mostly economic issues are related to the strategies applied in horticulture organizations**.** I briefly showed how these strategies draw upon certain logics and criteria for success, thereby being connected to the abilities, expectations and understanding of the growers involved. Social institutions as norms and strategies influencing innovation practices are the central research subject. The next step is to determine how this relation can be studied.

A conceptual basis is needed which guides the research and determines the concepts and relations that form the core of the analysis. In this chapter, I will provide this theoretic framework that defines the conceptual basis, discussing how my research is positioned in field of Industrial Ecology, which is the scientific field this thesis is written in. At the end of this chapter, I will conclude on the theoretical framework that I will use in my research. After, I will briefly discuss how this perspective will build further upon previous research on innovation in the horticulture sector.

3.2 The social side of Industrial Ecology

This thesis is written as a final product of the master of Industrial Ecology. The field of Industrial Ecology originally developed around the notion of 'industrial ecosystems', referring to the metaphor of sustainable natural ecosystems. By exploring the success of natural ecosystems, inspiration and innovative routes are provided to change present unsustainable industrial systems (Korhonen et al, 2004). Much of the research efforts dedicated to industrial ecology originated from natural science and engineering background, focused on eliminating physical pressures on natural ecosystems, through water, waste, emissions and material extraction. Common analytical tools that are used to gain a better understanding of these flows between social and natural systems are substance-flow analysis, material flow accounting, life-cycle analysis and material-flow analysis.

Using the metaphor of ecosystems, industrial systems should develop cyclic material flows, energy cascading, and waste utilization, through concepts as industrial symbiosis, process optimization, sustainable design, and renewable energy development. Although these solutions with a focus on energy use and physical flows of matter are important to solve sustainability issues, authors as Cohen-Rosenthal, Ehrenfeld and Boons have pointed out that the human dimension should be considered, by including the actors connected to these flows, such as firms, households, governments, NGO's, and individuals (Korhonen et al, 2004). The important insights that the tools in Industrial Ecology (IE) give can only be used when the actors involved can be brought to action toward the created vision:

"But actual change toward these future visions and a move toward a more sustainable situation will not happen without understanding and influencing human behavior, and will require shaping the concrete measures that decision-makers, firms, and individual consumers implement in practice" (Steger, 1996).

The notion of industrial ecosystems can therefore not just be compared to simple ecosystems, as they are driven by human thought and action (Boons and Roome, 2001). The ecosystems should rather be viewed as social systems, containing all types of humans and organization, social interactions, mechanisms and processes. Following from these insights, more of the recent work has been exploring the question how obtained insights and visions can be translated to real life actions, addressing the social embedding of industrial ecosystems. Only the combination of the engineering insights on potential improvements and social studies on people, management and policies allow us to create sustainable and effective solutions.

Sciences like sociology, political science, psychology and anthropology can provide insights in the social aspect of the suggested solutions. In this thesis, both anthropological and sociological insights are included to build a better understanding on how the industrial system of Westland horticulture sector could develop

towards a more sustainable system. The horticulture sector will not merely be looked at as an industrial region made up of companies; material flows, energy use and waste, but will be looked at from a social perspective, studying the actors, their choices, strategies, actions and social networks. The innovation system approach, as discussed by Hekkert seems a suitable approach allowing social system elements in the study of innovation, and will now be discussed.

Innovation systems

The concept of innovation systems as described by Hekkert et al, provides a useful frame to study technological developments in social systems: it is a "*heuristic attempt, developed to analyze all societal subsystems, actors, and institutions contributing in one way or the other, directly or indirectly, intentionally or not, to the emergence or production of innovation*" (Hekkert et al. 2006: 415). The notion of innovation systems, and the embedding of technological development in social structures and actors is providing a more integral perspective on innovations in systems. However, it does have some weaknesses, as the authors themselves identify. First, the analysis of innovations systems is based on social structures as relations and institutions to explain characteristics and differences of systems, but do thereby not automatically take the dynamics of these systems into account (in the analysis). Second, it does not address the agency of actors well. This is problematic, the choices and actions of the entrepreneur on 'micro level' have the determining say in what innovations will actually take place:

"*One might say that the innovation system framework suffers from institutional determinism; this is problematic, since the individual perspective– especially that of the entrepreneur(s)–is fundamental in practically all innovation literature. The entrepreneur is even likely to (now and then) overthrow and change (parts of the) structures around him, thus forcing the process of technical change into new directions*" (Hekkert et al, 1006: 414).

I will contribute to the innovation system approach by placing a stronger focus on the role of actors, their decisions, strategies and relations, and help to understand the social processes of innovation. By gaining a better understanding of innovation practices and social institutions affecting innovation, insights can be obtained on how the innovation system functions. This research effort shows that innovation in an (agro-) industrial region towards a more sustainable future cannot solely be explained through analyzing the physical (material and energy flows, and technologies that provide the possibility of reducing those), and structures but that the actors, their ideas, values, practices and relationships are crucial elements in the transition towards a more sustainable future.

The definition of innovation I will use in my research highlights the social element of innovation, and therefore deviates from the conventional definition. Scheel et al (2010) discuss the place of innovation in the field of Industrial Ecology and express it as "*the use of appropriate technologies, and insert them into effective innovation chains (from ideas to entrepreneurship) to remedy, recycle, reuse or redesign industrial processes and, with this new design, be able to minimize or eliminate the negative impact […]."*(Scheel et al, 2010: 199). While the innovation in this definition is closely tied to technologies, I will focus on the novelty of the innovation *practice*, rather than the innovation itself. This will be further explained in the next section.

3.3 Social innovation

The effect of social institutions on innovation in the horticulture sector forms the subject of this thesis. The concept of 'innovation' is used in many scientific fields, as engineering, business, economics and sociology, thereby sometimes addressing quite different matters. It is therefore important to clarify what I mean with 'innovation'. As briefly discussed in the introduction, innovation does not have to imply a technical newness, but can also address the newness of the way of innovation, requiring a different 'mindset'. The innovation there lies in the *practice* of innovation, where people may have to overcome conventional strategies, routines, believes and norms. The two following examples illustrate how the adoption of technological innovations does

not have to imply socially innovative behavior. Likewise, an act of innovation that is socially innovative does not have to involve a technological novelty:

	Innovation:	**Type of innovation:**
A	*A grower cultivates tomatoes also in winter-time and uses lights to provide enough heat and sun-hours. Every year, new and more efficient lights are produced, and this year it's time for him to replace the old ones by new ones again. He has a good feeling about it, as the last three times, these lamps of this provider worked out well for him. He picks the most innovative and efficient ones for his greenhouse*.	The grower might pick the newest, most innovative lamps that provide more light for less electricity: the technology is highly innovative as he is one of the first to adopt them. However, the grower has picked new lamps already three times to replace the old lamps. The act of replacing lamps with new, more efficient lamps is innovative and still risky, but is not new as an act of innovation; he has replaced lamps already three times, which might already be embedded as routine or norm in his organization.
B	*A grower cultivates tomatoes but the prices he is getting are too low. He is desperate and comes up with an idea. Instead of focusing on decreasing his costs to increase the margin (like he's is used to do), he decides to step in his car and drive to Germany, to see where his tomatoes are sold. In the supermarket, he asks the consumers why they pick their tomatoes and goes back home with valuable information. He is happy he overcame the barrier he felt to go there and promises himself he will do this next year too.*	Visiting a supermarket may not seem very innovative. Also, there is not a new high-tech solution involved. Nevertheless, the act of going to a super market to obtain information is still very innovative from a social standpoint. The auction hall used to sell the crops, and after the system was abandoned, the norms of focusing on the process and costs were still strongly present. Visiting a supermarket meant overcoming a historical network separation and his norm on what the activities of growers are. His action is socially innovative, but not technologically.

Table 1 - Technological innovation and social innovation

Although the social and technological innovations often go together, it is for the purpose of this thesis very important to distinguish technological innovation from social innovation, as it concerns an independent and distinct type of innovation, taking place in human action and interaction and is therefore entirely dependent to social dynamics:

"*What is in the essence [social] innovation occurs on the level of social behavioral patterns, routines, practices and settings? And it is not at the level of material production, is where the decisive new combination of (social) factors and pursuit of socially recognized goals with different means occurs where social innovation concerned. The innovation of social interaction, forms of transportation, and behavioral patterns as true subject of matter purpose and "decisive/competitive'" factor demarcates social innovation from technical innovation*" (Howald and Schwartz: ?: 24).

The innovation thus lies in a new variation of social behavior, reluctant of physical novelties. I will therefore not include a study of technical innovations, but solely focus on social innovation, which can be understood in the light of several dimensions (Butkeviciene, 2009):

- ***Newness***, which is the common criterion for innovations. This could be a new idea, new value, or new knowledge, but also existing ideas in a different context.
- ***Non-materiality***, an idea, project or knowledge that results in social change. The role of new materials as technology is supplemental or a result of this social change
- **Uncertainty and risk**. Social innovations can be reacted upon differently, making uncertainty an important aspect. The innovation could lead to social change when adapted, could be transformed or abandoned.

Having defined the way I will study social innovation, I still need a framework to study the effects of social institutions on innovation practices. In the next section, the concept of social institution will be discussed.

3.4 Social institutions

"*The most important aspects of structures are rules and resources recursively involved in institutions. Institutions by definition are more enduring features of social life. Speaking of the structural properties of social systems, I mean their institutionalized features, giving 'solidarity' across time and space*" (Giddens, 1984: 24).

Institutions are significant practices, relationships, or organizations in a society or culture. They can be both internal to humans, such as routines and memories, but also institutions that have become more external to individual actors, such as shared norms and regulations (Elster, 2007). The enforcement of institutions can be formal (through sanctions) or informal (through social responses). Institutions such as norms for example are not considered to be formal laws within society, yet they may still work to promote a great deal of social control. But how do these institutions relate to individual action?

Society is often conceptualized in a duality of individual and society; or as agency versus structure consisting of institutions. The terms of structure, system, and duality of structure often appear in writings from structuralists and functionalists. Structuralists have given the idea of structure more thought while functionalism addresses society as a whole in terms of the function of its constituent elements; namely norms, customs, traditions, and institutions. Often, structures have been interpreted as some kind of patterning of social relations or social phenomena. Critiques of scholars such as Giddens state that in those perspectives structures are "naively pictured as the skeleton of a society, or as something external to human action, as a source of constraint on the free initiative of the independently constituted subject" (Giddens, 1984: 16). Giddens however suggests a different perspective in which structure is seen as part of individual action that reproduces structures every day (Giddens, 1984: 16). This allows for change to happen, as the structures of society are reproduced by individuals daily, providing room for variation and change, rather than defining them as hierarchical and external organizations individuals do not interfere with. Subsequently, it allows social innovation to occur, which brings variation to structure and might overthrow them. This perspective on institutions will be used, as in this thesis, individual decision and social action of the individual growers is studied, which means there needs to be room both institutions as well personal believes, values, and strategies. When individuals display new variations of ideas, actions and values diverging from conventional structures - or social institutions and norms shared believes - we call this social innovation.

Nevertheless, the structuring properties are important elements in this thesis, as they "allow the 'binding' of time-space in social systems: they are the properties which make it possible for discernibly similar social practices to exist across varying spans of time and space and which lend them a 'systematic' form" (Giddens, 1984: 17). Stated differently, the structures have a more persistent nature and allow enduring social phenomena to exist, such as a shared culture in the Westland, or shared strategies amongst the growers that enable them to use successful ones over generations. The most deeply rooted structural properties, implicated in the reproduction of social totalities structural principles can be referred to as *institutions* (Giddens, 1984: 17). We will study these institutions in this research, explaining how these more enduring properties influence innovation practices. The stronger the shared institutions in the horticulture are present, the more likely they exert power of innovation practices of growers, which may mean that conventional ways of innovating are maintained. This can give insights in why innovation strategies are continued, despite their effectiveness, and why social innovation may mean to overcome quite some norms, believes, logics and strategies. The analysis lies therefore at the interaction of individuals and structures: on the power of institutions on growers, on individual freedom of choice, and the ability of the growers to produce new variations of the institutions, thereby potentially overthrowing structures.

As just touched upon, the structures or institutions of societies are often seen as the constraining elements of social life, limiting the agency – or free behavior – of individuals. Nevertheless, these structures also *enable* activities for individuals. This 'duality of structure' implying the dualism that the structures of

society are (re)produced by individuals, creating the structures, but thereby draw themselves on these structures when doing so. This idea in itself is interesting as it gives a more dynamic perspective on societies, wherein individual actors are constantly redefining the structures, which in their turn define the social structures individuals are acting in, both enabling as well as constraining them. This dualistic perspective of society gives a more dynamic view on social systems than the structuralistic and functionalistic interpretations on societies and change, as it addresses the role of individuals creating the structures. In my approach, individual decision making and social innovations take a central place, which makes the agency of individuals an important element of study. After all, the social innovation implies new variations of structures, thereby overcoming the 'power' of institutions.

In this study, I will make a distinction between formal and informal institutions, because they are different in nature, the actors enacting the institutions are different and also the types of (potential) punishment are dissimilar:

3.4.1 Informal institutions

> "*It is always the case that the day-to-day activity of social actors draws upon and reproduces structural features of wider societal systems*" (Giddens, 1984: 24).

The region of the Westland has a long history of horticulture and has been a region with its own culture and developments. The horticulture sector coincides with a community and a culture that is tightly intertwined with the sector, which makes the horticulture cluster – although increasingly industrialized - still an interesting case to research from a social perspective. The cluster is both characterized by the embeddedness in a community, as well as being a sectorial network. Dal Fiore shows that communities have a tension towards homogenization/conservation, drawing upon a space of belonging, while networks have a tension towards differentiation in a space of comparing, influencing the process of social innovation (Dal Fiore, 2007: 857). Both characteristics may be present in the Westland horticulture cluster. They may be studied by studying their presence amongst members of the community.

3.4.2 Formal institutions

Formal norms differ from informal norms in the sense that they are enforced by specialized agents who typically impose direct punishment on the violator, rather than ostracism or shaming that are more common to informal institutions (Elster, 2007). These organizations exert power via the consideration or 'fear' of the punishments tied to the institutions. In this the case of the Westland, formal institutions affect the decision making of growers via contracts, regulations and agreements. These can be studied with by interviewing growers and experts, as well as conducting document research.

This typology and the perspective on institutions of Giddens does not provide a satisfactory framework yet to study the effects of these institutions on social innovations, as it is not explicit enough how this can be studied. In the next section, I will introduce the framework that does include the interaction of the individual with the more enduring social structures, but is more explicit in how these should be studied.

3.5 The conceptual framework

The aim of this research is to explain how social institutions affect innovation practices and how growers make their innovation decisions. A framework that provides a sufficient structure for explanations on these social processes is needed: "*Social theory has the task of providing concepts of the nature of human social activity and the human agent which can be placed in the service of empirical work. The main concern of social theory is the same as that of social sciences in general: the illumination of concrete processes of social life*" (Giddens: xvii).

As Giddens states, the purpose of social research is to explain the workings of social life, and the activity of individuals in special. Empirical work provides the method to gain better understanding of the

human beings, thereby studying concrete processes. The individual plays a central role in my thesis, as these are the actors adopting novelties and creating social innovation, the framework I use should address the position of individual well, but has to include the influence of social institutions likewise. The conceptual model as introduced by Coleman, often referred to as the 'bathtub' model, does satisfy these criteria and will be used as the core framework of my research.

The typology helps understanding how different societal levels relate to each other, and help explaining change at the intersection of both (Coleman, 1986, Hedström and Swedberg, 1998). The advantage of the model of Coleman, is that he is more explicit about the relations between micro and macro, and divides it in different steps of explanation. These explanations on social events require one or more mechanisms that address the processes through which these events and transitions develop, and how individuals and macro structures evolve over time (Hedström and Swedberg, 1998). The model is based on the assumption that change and variation should be explained through individual action creating change at macro level, and macro level affecting individual behavior. The typology distinguishes four types of mechanisms, as can be seen in figure 5.

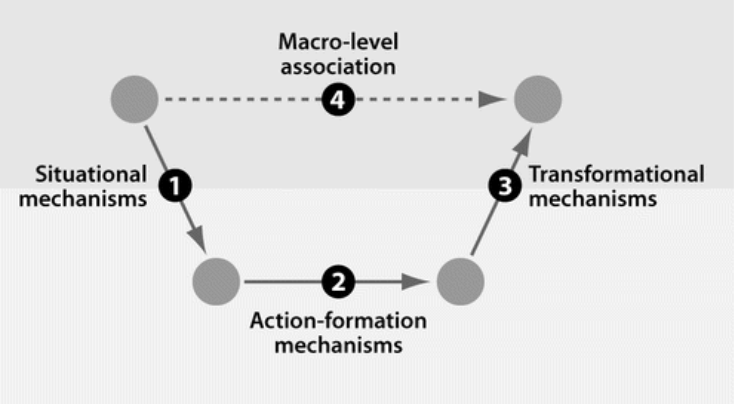

Figure 5 - The 'bathtub' model on social action, as introduced by Coleman

As the effect of social institutions on innovation practices by individual growers is studied, the explanations will include mechanisms one, two and three, as the explanation via macro-level association does not include individuals. The line of analysis consists therefor from:

1. *Situational mechanisms*: explanations on how macro events or states (in this research: social institutions) affect individual behavior. The mechanisms illuminate how social structure or other macro-sociological event or states link to the beliefs, desires and opportunities of an individual actor (Hedström and Swedberg, 1998). These types of mechanisms help define how personal properties of individuals may be influenced by present institutions.

2. *Action-formation mechanisms*: explanations on how individuals assimilate the impact of macro-level events, and how they arrive at actions. The decision making of individuals enables the incorporation of institutional influence as well as personal preferences, goals and believes. The descriptions take place at the individual level; micro-micro level (Hedström and Swedberg, 1998). Individuals generate action, as a result of their beliefs, desires, and action opportunities. These mechanisms are therefore very useful to explain individual behavior of actors, as researched in the ethnographical fieldwork.

   The assumption on decision making in this study is that decisions are influenced by their (anticipated) consequences, including both personal and social/regulative factors. With personal I mean desired consequences as making a profit or creating an organization resembling an ideal, with social consequences aiming to prevent social sanctions as shaming or avoidance, and with regulative consequences

punishments as penalties. Decisions are therefore purposive, but may not have the anticipated outcome, as actors are bounded rational: they may not be able to understand the effects of their actions.

3. *Transformational mechanisms*: indications on how a number of individuals create macro-level outcomes through their actions and interactions. The explanations address the relation between the micro to the macro level. This type of mechanism regards the analysis on how macro events or states influence individual behavior. The macro institutions effect individuals in a certain way. The mechanisms illuminate how social structure or other macro-sociological event or states link to the beliefs, desires and opportunities of an individual actor (Hedström and Swedberg, 1998). These type of mechanisms help define how personal properties of individuals may be influenced by present institutions.

The bathtub model provides a framework that allows the study of social institutions in several steps. First, those social institutions influential to innovation practices should be determined. Second, the decision making of individuals who deal with these institutions should be studied. Third, explanations should be provided on the action-formation of innovation practices following from the decisions. And lastly, insights can be obtained on system level phenomena, by explaining how these may rise from the action and interaction of individuals.

3.5.1 Framework application

The bathtub model provides a perspective on the way the effects of social institutions on innovation practices can be looked at, but it does not yet explain *how* it can be studied. The model should still be applied to the situation of the horticulture sector, and should preferably also suit the step towards modeling to some extent. As will be explained in this paragraph, 'grounded theory' will be used to come to hypotheses and theoretic explanations on social behavior. This way of arriving at theory contradicts the traditional model of research, where the researcher chooses a theoretical framework, operationalizes it into variables, and only then applies this model to the phenomenon to be studied. In this thesis, the bathtub model is used to define the perspective on the relation between micro and macro levels. The mechanisms tied to the three steps of explanation (Situational mechanisms, Action-formation mechanisms, and Transformational mechanisms) indicate *the type* of mechanisms that can be used to explain patterns and dynamics, but do not yet indicate *which* mechanisms are appropriate, as this will be the result of the analysis.

In the coming two paragraph, I will explain how the IAD framework by Ostrom will be used to bridge bathtub model perspective towards modeling purpose, identifying some main 'blocks' that are used to identify system elements for modeling purpose. After, I will explain how the practice of grounded theory will be used. The methodologies that are used will be further elaborated on in the methodological chapter: chapter four.

Adapting the bathtub model to modeling purposes

This research has set the goal to provide valuable and realistic information from empirical methodologies and social analysis, to reach a rich system description suitable for agent-based modeling. The IAD (the Institutional Analysis and Development) framework, used in social and political science, provides the central assumptions and structures for the model of artificial frameworks (Ligtvoet et al, 2010).

The IAD tool was developed by Ostrom and others, as a tool to grasp human behavior and understand outcomes of social action and interaction. It provides guidance in grasping underlying structures of social systems and its operational environment and will be used in this study as such. (Ghorbani, 2012). The framework is made to structure research on social patterns of interactions and to analyze outcomes, given a set of criteria. The IAD framework is based on building blocks defining social interactions, as can been seen in figure 6.

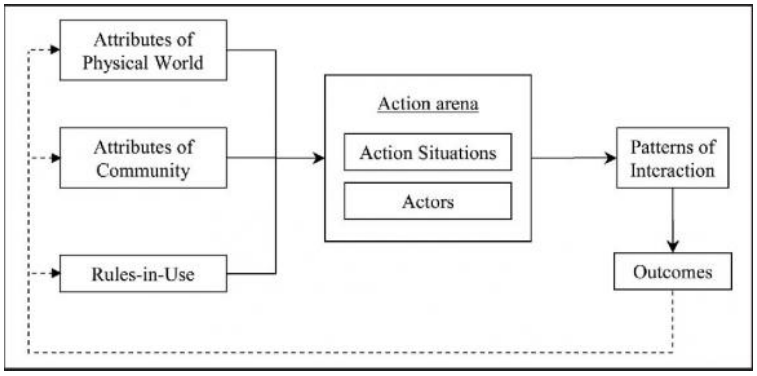

Figure 6 - The IAD model

Ostrom et al. propose IAD as an institution-driven tool that seem to suit the three steps of explanation of Colman's bathtub model well, but do provide more guidance to it through conceptualizing it further:

a) Understanding the underlying structures of a social system (the blocks on the left side of Figure 6)
b) Capturing the operational environment (the action arena, at the center of Figure 6)
c) Observing the patterns of interaction and outcomes, given a set of evaluation criteria (depicted of the right side of Figure 6).

The institutions that define social interaction, are defined as Ostrom's suggestion "*the set of rules actually used by a set of individuals to organize repetitive activities that produce outcomes affecting those individuals and potentially affecting others*" (Ostrom as cited by Ligtvoet et al, XX). This narrows the definition of institution down to only those institutions *actually used and affecting the actions of study*. For this study, this means that only those institutions that can be directly linked to innovation practices will be used in the model, and will therefore be the central to my social research, narrowing down my focus towards innovation practices and relevant institutions explicitly.

The AID framework relies on the presence and richness of social institutions in a system, and is therefore a framework that goes well with modeling. The variety in decision making by actors should thus result from describing different types of actors that display different behavior, resulting from different believes, roles and states and the way they deal with institutions as norms. Empirical research on the level of individual grower helps in this sense to portray the variety of actors.

The IAD framework is suitable to translate the perspective on social systems and social action from Coleman into those specified blocks that can be used for modeling purposes, as the IAD framework has the same elements in it as the bathtub model of Coleman: social institutions, actors making decisions dealing with institutions, and a part about system patterns emerging from individual action. The elements that are required for making a model description, and that can be explained with social mechanisms described in the bathtub model, will be studied in the fieldwork, are described in the second column of Table 2.

The 'building blocks' in the table are the necessary elements to build a model description, and should therefore be addressed in the empirical research in the field. However, the research is exploratory, which means that the variables and theoretical elements explaining social phenomena are not defined beforehand. This means that Table 2 defines *the elements* in the system that should be studied, but does not describe which variables and mechanisms will be used. The use of grounded theory, as the methodology to arrive at the specific mechanisms of explanation, will be further explained in the next section.

IAD elements	**Building blocks defining social interactions in the IAD framework (Ostrom)**	**Explanatory mechanisms as in Coleman's model**
System structures	Attributes of the community: the actors involved, their properties and roles they can take. The growers and their characteristics, as well as the other important organizations active in the sector.	Situational mechanisms; provide explanations on *how* institutions and structures affect individuals
	Some indications on the physical components, in the case of the Westland, the greenhouses, crops, innovations, etc. crucial to understand the innovation practices of growers.	
	The social institutions (rules) that are embedded in the social system; both the informal institutions as norms and shared strategies, as well as formal institutions including regulations, contracts and agreements. These formal institutions are tied to other organizations in the sector.	
System dynamics	The action arena; the way decisions are made on individual level and the way social institutions are anticipated on. Also the interactions between actors should be clarified, and the way the physical components are used and affected.	Action-formation mechanisms; explain *how* actors arrive at decisions and actions
System outcomes	The evaluative criteria, or the expected system-level outcomes. These macro phenomena are the outcome of social processes, and can be studied as such. For modeling purposes, these system outcomes are used as the evaluative criteria.	Transformational mechanisms; explain *how*

Table 2 - System elements to be studied in the empirical research

Grounded theory

In this thesis, the methodology of 'grounded theory' will be used to arrive at explanations on social behaviour. This systematic methodology involves the discovery of theory through the analysis of data. It contradicts in that sense with the traditional social science research, as it does not begin with a hypothesis, but concludes on it. 'Orthodox' social sciences define problems in the same way as in natural sciences, researching social causation when explaining human behavior, relying on deductive explanations (Bryson, 2000; Giddens, 2006). The ethnographic fieldwork will form the starting point of the research process. This espestimology relies on the *inductive analysis* of the collected data, "*Knowledge must be inductive, in which researchers begin with particular observations, from which empirical statements are made, which may, or may not, lead to statements of more generality*" (Bryman, 2000). The empirical statements are in general the patterns that occur in the material. It is thus of vital importance that the data is structured in such a way, that patterns can be found by the researcher. The methodological steps making up this process will be described in chapter 4, the methodological chapter. In this chapter, the *epistemology* supporting grounded theory, and the use of ethnographic fieldwork is the subject of discussion. With epistemology I mean the theory of knowledge, defining what knowledge is and how it can be obtained.

The epistimolgy of ethnograpgic study, using grounded theory to come to hypothesis and theorethical explantions on social phenomena, is based on empiricism. To obtain information about the real world 'out there' on the elements summed up in table 2, emperical research is used a way to gain knowledge by means of direct and indirect observation or experience. The empirical evidence can subsequently be analyzed quantitatively or qualitatively. The first part of the research concerns fieldresearch, drawing upon ethnography, well known in the field of Anthropology. Knowledge on the world is obtained by emperical methodologies, observing and describing findigs that are obtained by direct witnessing of the researcher:

"*Ethnography is the study of people in naturally occuring settings or 'fields' by methods of data collection which capture their social meaning and ordinary activities, involving the researcher participating directly in the setting, if not also the activities, in order to collect data in a systematic manner but without meaning being imposed on them externall*y" (Bryson, 2000: 6).

The method of ethnography cannot be seen seperately from the methodology, that implies a certain

perspective on how the social world can be understood. Besides descriptions on how ethnography should be executed and written, the consideration of theorethical issues raised by the method are connected. Examples of this are the reflexivity, representation and realism of data production (Bryson, 2000).

The value of this methodology is understanding the variety of actors, their perceptions, processes, nearing the ontological perspective of rationalism. The causal agents of change are the identity, preferences and interests of individual agents, which are fluid and constituted by relations and ongoing interactions. The causal mechanisms emphasize processes such alignment, enrolment, attachments, translation, co-construction and mutual constitution. These descriptions on innovation practices of growers oppose the view of rational and value-maximizing economic actors.

Also, it provides insights in relations and explanations, that are often missing in structuralistic or functionalistic methodologies, as in some sociological schools, and in modelling. The messy, unstructured and undirected nature of fieldwork carries the problems of processing and analysing the data, but carries as the same time the potential to distill the variation of social life, and overcome the contrained view deductive research brings. The ethnographic fieldwork will provide information about which social institutions are dominant, how growers make decisions on innovations, how they bring innovations in to parctice, and how they interact with one another.

The use of agent-based modeling entails a quite different epistomology, as the assumption underlying modelling, is that insights on the social system of the Westland can be obtained through creating an simulation of the system; a model. System dynamics can be studied with the model exploring how system-level outcomes emerge from the action and interaction of individuals. It adheres to Coleman's bathtub model, assuming that system patterns can be understood through the study of indivdiual social action:

"*Agent based models implement Coleman's critical realist epistemology but with an additional qualification: the macrosocial outcome is also more than the sum of its parts. This concept, known as emergence, was anticipated by Durkheim: 'The hardness of bronze lies neither in the copper, nor the tin, nor in the lead which have been used to form it, which are all soft or malleable bodies. The hardness arises from the mixing of them' (Durkheim [1901] 1982, pp. 39¡40). The principle applies as well to sociology, he continued: '[Social] facts reside in the society itself that produces them and not in its parts—namely its members'*. (Macy and Willer, 2002).

The theoretical interest of agent based modeling is that it focuses on dynamic social networks that shape and are shaped by agent interaction. Agent-based models are thereby used to perform virtual experiments that test macrosociological theories by manipulating structural factors like network topology, social stratification, or spatial mobility (Macy and Willer, 2002). The assumptions on how knowledge can be obtained are therefore quite different than in empercism. In this reseearch, both of them are used as integrated methodological steps, as well as a way to triagulate the findings of both.

3.6 Contribution to previous research

Innovation in the horticulture sector has been an interesting topic for several fields, due to its unique character. As described previously the Dutch horticulture sector is well known for its innovativeness, leading to global leadership in horticulture, thereby overcoming disadvantages in sun hours, temperature and land price. Innovations in technologies, bio-technology, and processes are strongly represented in the work of influential research institutes like Wageningen UR Glastuinbouw, TU-Delft, Greenport Holland, Productschap Tuinbouw, and TNO. More recently, studies focusing on the social aspect of innovation have become more popular by academics at Utrecht University, Wageningen UR, TUDelft and Eindhoven University. Verstegen and Lans from the Wageningen UR for example have studied entrepreneurship in the agricultural sector, focusing on the changing role of the growers and farmers, who are becoming entrepreneurs of large organizations, thereby moving away from the hands-on growers they used to be supported (Verstegen and Lans, 2006). The authors pose the question what the conditions for good entrepreneurship are, and how the entrepreneurs in the

agricultural sector can be supported in acting in their changing position (Verstegen and Lans, 2006: 2). The authors argue that the entrepreneur should be a good craftsman, be able to maximize the biological processes in his company, have managing skills to streamline the different types of processes in a company, and have qualities to interact and react to the external market and stakeholders. Lans en Verstegen show that the entrepreneurs are often seen and pictured as solely 'grower' by themselves and others, highlighting just one aspect from their responsibility (Verstegen and Lans, 2006: 2). The authors underline the issue of the shifting responsibilities of growers that came with scale enlargement and the changed market structure after the auction hall was abolished. The new market structure led to a new field for competition, shifting the responsibility to sell products towards the growers (Jacobs, in: Boom in Business). Growers leading a greenhouse were therefore no longer solely growers, but became entrepreneurs leading large organizations towards an uncertain future.

The expected value of this analysis it that it shows how the functioning or disfunctioning of horticulture organizations are largely based on human competences, as the authors shows in opportunity, relationship, conceptual, organizational, strategic and commitment competences (Verstegen and Lans, 2006: 7). Moreover, Olaf Hietbrink, head of the research group Entrepreneurship of Wageningen UR, stresses in an interview the importance of the entrepreneur in innovation: "*Agrarische ondernemers zijn nog steeds de spil waar het in de landbouw om draait. Je kunt nog zo veel regels bedenken, uiteindelijk komt het toch bij de ondernemer terecht. Als die niet wil of kan, komt er niks van het beleid terecht*" (interview by van Maanen and Gert, 2006). Verstegen, Lands and Hietbrink identify exactly the importance of social side of innovation in the horticulture sector; in the end, it is the entrepreneurs that run organizations, make the decisions and make the investments. In their article, Verstegen and Lans approach the entrepreneurs of the horticulture sector as human beings with talents and weaknesses, thereby opposing the idea of economic actors as fully rational and competent actors. In my research, I take the same proposition, studying actors in their context, network and personal characteristics, placing innovation practices in a social and personal setting.

Innovation in the horticulture sector has also been researched at the Eindhoven University by Frank W. Geels and Eric Berkers. Geels' and Berkers' research covers sectorial innovation systems and transition management, studying innovation with a multi-level perspective. The value of their perspective is that in enables to study the interaction between different levels of social life. More specifically, the struggle of new innovations (niches) to break through the present system and often persisting meso-level (regime) is a valuable approach of innovation. It addresses the difficulty of new technologies ideas or norms to become accepted, as they may conflict with existing interests, norms or physical structures. In my research, the social institutions I study form the regime, or sometimes the landscape (larger social trends), in which new innovations are competing to be accepted and spread.

In a report made for the Transforum project, written by Geels, Elzen, Berkers, Leeuwis and Mierlo (2008), the innovations in the horticulture sector are described with a perspective of innovation-sociology. Here, the role of actors, networks, social intuitions as cognitive, normative and regulatory rules are the central topics of research. Geels et all have conducted extensive research on system innovations in the Westland greenhouse sector as well as in pig farming (F. Geels et al, Transforumproject, 2008). The authors approach innovation of the cluster with the theoretical background they call innovation-sociology, taking three multi-dimensional processes as focus points: technologies (systems and components), actors and social networks (cooperations, market relations) and regime rules. The latter is further divided into cognitive rules (routines, belief systems, guiding principles), normative rules (roles, behavioral norms) and regulatory rules (laws, emission-rules, standards).

I continue on this line of research by exploring how these system components come together in innovation practices of individual growers, thereby answering the research questions a) how the institutions affect growers' decision making, b) how actions result from their decisions, and c) how system-level patterns arise from individual actions and interactions. Similar to Geels, my work is an effort to grasp and analyze

complex socio-technical systems, the relations between the individual and system, and the relations between agency and structure, which has been a central topic in social science and innovation science for centuries. Where Geels et al. use the multi-level perspective (MLP) and strategic niche management (SNM) in their research to answer the question how micro and macro (?) levels are connected, and how innovation takes place in the sector, my research will use Coleman's Bathtub model to understand the relation, structure and dynamics between the individual and the system. As in the research of Geels et al, my work both includes both an 'outside in' as an 'inside out' analysis (Poole and Van de Ven, 1998 as quoted by F. Geels et al, Transforumproject, 2008):

"*The 'outside in' analysis has a strong focus on patterns, while the 'inside out' perspective takes actors that navigate, act, interact, as a starting point"* (Poole and Van de Ven (1998).

My research continues on the work of Geels et al by providing a detailed description of the actors and their 'navigations, actions, and interactions', resulting from in-depth research on innovation practices of individual growers with ethnographic fieldwork. My work provides an 'outside in' analysis by studying the social institutions and their effects on innovation practices of growers, as well as an 'inside out' perspective by studying the decision-making of actors leading to system-level phenomena. Moreover, the emergence of system level patterns can be further researched by using the agent-based model that will form another outcome of my research. The agent-based-model provides an 'inside out' perspective, explaining a system by its components, called generative science.

3.7 Conclusion

In this chapter I have presented the theoretic framework of my thesis, first starting with the positioning of my research in the field of Industrial Ecology. I defined some of the core concepts of my research, describing the way I use the concepts of social innovation and social institutions. In the succeeding section I introduced the framework of Coleman on the theory of action, explaining how I conceptualize and study the effect of social institutions on innovation practices. The bathtub model is very useful to conceptualize the relation between micro and macro levels, but does not give insights on how this can be studied in a social system as the Westland, or how this perspective may be used to model.

Therefore, the use of 'grounded theory' was discussed to explain how the conceptual value of the bathtub model can be used in the empirical research in the sector. The IAD typology was introduced as the framework that helps to bridge the research on social action to modeling, as it has been used with satisfaction as a conceptual framework for modeling purposes (Ostrom as cited by Ligtvoet et al, XX). The core 'building blocks' making up the IAD framework are therefore elements that will be studied in the empirical research, to ensure that a model can be described at the end of the empirical research. The use of the IAD framework has the benefit that it relates to both the bathtub model, that addresses the way social action can be explained with social mechanisms, as well as it describes in more detail how a system can be studied and described in such a way, that it is suitable for modeling purpose.

In the last paragraph, I discussed the way this perspective contributes to previous work on innovation in the horticulture sector. In the next chapter, I will describe the methodologies that I use in the process of exploratory research and the creation of theoretical explanations on social action is the horticulture sector. The process of grounded theory is further clarified, showing the steps of operationalization of this research.

4 Methodologies

4.1 Introduction

The aim of this study is to get a better understanding on the way social institutions affect innovation practices. Moreover, I am interested in understanding how growers make their decisions, balancing their personal ideas and values as well as shared institutions as norms and regulations. To understand the social system, and in more detail the decisions of individual growers, a major part of my research is to gain this understanding of the world 'out there'. In this chapter, I will explain how fieldwork and ethnography, well known to the field of anthropology, are used to gain this inside perspective on innovation. The methods used in the fieldwork are also described.

The information acquired via ethnographic studies provides a rich set of data, which has to be ordered and studied to be useful for social analysis, to arrive at hypotheses and explanations on social phenomena. The methodologies of translating the rich and messy product into a manageable dataset will be described. After that, I will explain how the bathtub model from the American sociologist James Samuel Coleman, as introduced in chapter three, will be applied as a framework to study the relationship between the macro structures of society and individual decision making and actions. In the end of the chapter, I discuss the methodologies of the challenging step of translating the abundant social data and analysis to a model description in the software of MAIA.

In this chapter, I will account for the successive methodological steps from grasping information from a real system, structuring it, analyzing it and translating in into an agent based model – designed to study the dynamics of the system of study. Altogether, this chapter explores and concludes on the ways empirical research can be executed, analyzed and processed to become valuable input for modeling purpose.

4.2 Research process

As briefly discusses in chapter two, my research consists of four steps that should be well connected through the methodologies used, to join the steps into one research approach. The four main elements of this research are:

I. **Ethnographic fieldwork** to obtain information via observation or experience. The empirical evidence can subsequently be analyzed quantitatively or qualitatively. Knowledge on the world is obtained by emperical methodologies, observing and describing findigs that are obtained by direct witnessing of the researcher
II. The **organization, structuration and coding of data** to create a dataset that can be well studied. This step of coding is also a first step of the analysis, as during the coding process, the variables are identified and first thoughts on patterns and dynamics are captured in memos.
III. In the **Social analysis,** explanations are provided on the observed human activities**.** The memo's and coding of the previous step form the input of the analysis. Patterns being found in the data are explained through the use of social mechanisms. These mechanisms explain 'the specific by the general', and will provide potential explanations on *how* changes occur, *through which processes*. These used mechanisms are potential explanations, identifies as useful in this thesis.
IV. **Working towards a model description** based on the findings of previous steps, thereby exploring what can be learned from the combined use of ethnography and modeling.

The research process can be devided into four methodological steps that are showed schematic in Figure 7. The first box features the emperical fieldwork, creating data directly from the social system and on actors using ethnography and data strcuturation, creating a rich data set of information. The second box shows the step of analysis on the data, based on grounded theory, which means that the first step is data collection (rather than posing a hypothesis). This methodology is especially useful in exploratory research, as the scope of research is kept open. From the collected data, the key points are marked with a series of codes, which are extracted from the text. The codes are grouped into similar concepts in order to make them more workable to find patterns in.

From these concepts, categories are formed, which form the basis of creating theory (Babbie, 2004). In the step of analysis, some theory on social mechanisms is however used to help explaining social behaviour. In the last step, the rich data and analysis are used to create an agent-based model. In the next sections, the four successive steps and methodologies are further explained.

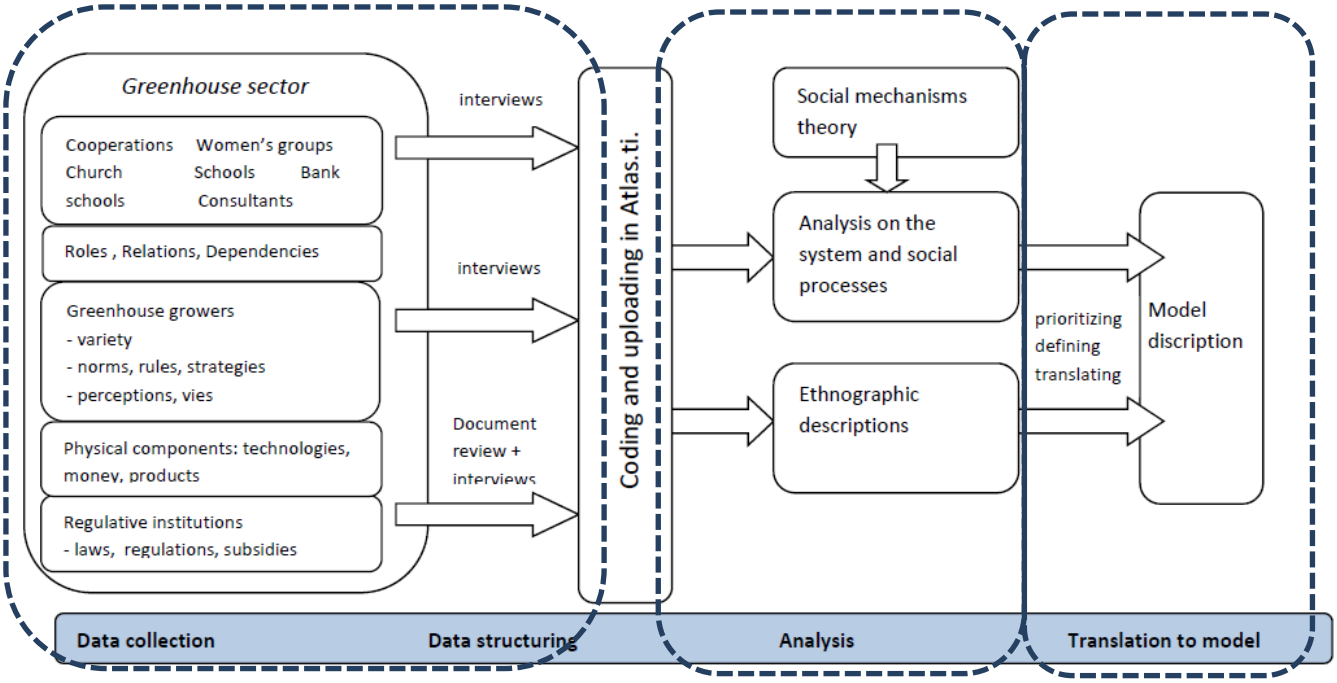

Figure 7 - Research process

The outcome of the fieldwork and social analysis are used to make a model description in the MAIA meta-model that allows the model to be socially richer than most other agent-based models are. The empirical research should therefore provide a level of richness and detail to be used and give insights in whether the MAIA metamodel is fit to capture the richness. Setting up the fieldwork conform the guidelines that are generally used in anthropological fieldwork does provide more data than will fit into a model, making the translation step more challenging, and therefore interesting. It is nevertheless wise to incorporate some of the framework and concepts that are used in the MAIA model to be certain the right information will be available, as the MAIA meta-model does specify the concepts of a social system that are used. Therefore, the work of Ostrom, Coleman and Ghorbani are important input for setting up the research structure and focus.

The social concepts used in thee MAIA model, are shown below in Table 3. The building block as first introduced by Ostrom and colleagues in the IAD framework, and as adopted by Ghorbani are core elements in the meta-model named MAIA (Ostrom, 1994; Ghorbani, 2012; Ligtvoet). The framework provides guidance in how underlying social structures can be understood (row I). Second, it aims to capture the operational environment in which actors act, interact and change the system (row II), and third; it helps in observing patterns of interactions and outcomes, given a set of criteria (row III) (Ghorbani, 2012).

	MAIA Blocks	*System elements*	*Attributes*	*Value adding*
	Collective structure	The actors and their attributes	- Types of actors	- Broader conception of agent (Scott)
			- States of actors	- Realistic agent descriptions (ethnography)
			- Perceptions of actors	- Relations, dependencies and power
	Constitutional structure	Social concepts and relations	- Roles	
I. System components			- Objectives	
			- Dependencies	
	Physical structure	Physical aspects of the system	- Materials	
			- Energy, Money	
			- Technologies	
			- Physical connections	
	Operational structure	The mechanisms and workings of the system	- Actions	- Social and economic mechanisms underlying behavior and change
II. System dynamics			- Action arena's	
			- Action situations	
			- Action sequences	
III. Model evaluation	**Evaluative structure**	The concepts that are used to validate and measure the outcomes of the system	- Problem domain	- Empirical data and social mechanisms explaining emerging patterns in model
			- Validation	

Table 3 - Research framework

4.3 Fieldwork

To obtain information about the innovation practices, emperical research is used a way to gain knowledge making used of direct and indirect observations. The empirical evidence can subsequently be analyzed quantitatively or qualitatively. The first part of the research concerns fieldresearch, drawing upon ethnography, well known in the field of Anthropology. Knowledge on the world is obtained by emperical methodologies, observing and describing findigs that are obtained by direct witnessing of the researcher. The respondents and methods will be described in this section.

Respondents

In conducting ethnographic fieldwork I have interviewed various stakeholders in the Westland horticulture sector. I have done around two dozen interviews. The respondents of this research are described below:

- **Experts:** Discussions with experts, or key-informants, helped to direct the research and get better overall-insights on the sector, and identify main themes. Also, assumptions can be tested by the experts.

- **Growers:** Around 15 growers were visited at their organizations, the subsequent discussions ranged from 2 to 5 hours and provided insights in the grower's lives. Some of the growers are from the cooperation Prominent and selected together with the director based on their different stories and backgrounds. Additionally, growers from the Greenery were included to make the sample set varied. Lastly, growers not attached to ac cooperation, and also, with special or deviating story were included. These growers were contacted directly, or through introduction via other respondents, a method called the snowball-method. The selection of respondents was aimed at showing a realistic, varied set of stories.

- **Other organizations**
  - *Bank:* The Bank plays an important role in the sector, and is a key actor since they provide financial capital to companies. The interview gives insight in changing investments, requests, problems and bank-policy.
  - *Churches:* The church may help to understand the social context and linkages to religion and networks.

- *Educational institutes*: These institutes provided insights in how the new generation is educated and which discussions take place. Is there a friction between current practices and knowledge and education?
- *Municipality:* The municipality has the role to carry out policies, regulations and subsidies in the region, which makes them an interesting organization to include when addressing social change and institutions.
- *LTO Glaskracht*: LTO North Glass plays an effective lobby that is directly linked to market developments. The organization advocates the horticulture sectors, which means that the organization may play an important role in the creation of institutions.
- *Service providers, wholesalers, supermarkets:* These are important actors in the supply chain, but may not be included in in-depth interviews, due to the scope of this research.

Methods

Ethnography is not a simple set research methods, but can rather be described as a craft as the research is very much integrated with the interviewer's capabilities (Bernard, 2006). This means that the research is hard to describe in defined steps. Some methods will however play a central role in this research:

- *Open and semi-structured interviewing*: In this research both unstructured as semi-structured interviewing will be used. Unstructured means the conversations that can take place anywhere anytime, at a home, when waiting for a bus, etc. Semi-structured interviewing implies that the ending is open, but that the interview is guided by a list of topics (Bernard, 2006). This method is most useful in this research, as there is often one conversation per interviewed, and should therefore contain the needed information. The interviews allow discussions that are not prepared in advance, but do guide the discussion, making the interview for efficient.
- *Participant observation*: This method is the foundation of cultural anthropology, and involve mingling with people, getting comfortable with each other, making observation and recording of data about their daily lives and activities possible (Bernard, 2006). It is not a strict method, but rather a craft, or a skill that a researcher needs to develop to mingle with people, get comfortable, meet the right people, as the right questions and get people to talk and take her along. It is being at the places of activity, making the collection of data in daily lives possible. The data produced are notes, memos, interviews, recordings, and photos etc., which need to be structured and analyzed later on.

Interview materials and use

The fieldwork in this thesis is exploratory and is based on grounded theory. At the same time, some specific outcomes are needed to be able to indicate social mechanisms, and to be able to model the system in the last part of this research. Therefore, some interview materials were used during the interviews that can help to discuss specific topics. These interview materials can be found in Attachment 11.1. These materials may suggest that the interviews are structured, and that the outcomes are structured. This is not the case, as the interviews were quite open conversations, while often having a tour through the greenhouses, in group discussions and informal conversations during my presence in the region.

I. *Personal history description:* Life history has been used a lot by anthropologist, and is seen as a producing an important type of ethnographic data. Life histories are a focal point for the individual perception of and response to broader cultural patterns. The history description in this research was guided by a timeline that has been made up of literature, expert discussions and additions by respondents. The timeline includes important events in the horticulture sector, Dutch history, changes in regulations, and larger trends in society, and can be found in Attachment 11.1.7. These markings can guide the discussion, help to reflect on processes and changes, and make discussions of relations

easier. The value of this method was that the topic of social innovation and change, can be well discussed on a timeline, facilitating the discussion on relationships of events and processes.

II. *Innovation scaling:* this type of composite measure is based on scaling innovations on a simple scale, that range from 'less, neutral or more', 'little, medium, much' etc. This scalding does not say how much more or less the attribute related to each other, but value them in relation to each other. In the research, the scales were used to order types of innovations, for two reasons; first: to obtain a better understanding of how the respondents evaluate and define specific innovations, and second: to get a better understanding on how the respondents evaluate the innovations; and by which criteria. The scales included in this research are;

   a. Difficult to bring in to practice - Executable - Easy executable
   b. Past innovation - current innovation - future innovation
   c. Encounters resistance - neutral - is stimulated from outside
   d. Is uncertain - is moderate certain - gives certain outcomes

III. *Mechanism scaling:* Although ethnographic research is often open-ended and explorative in nature, in this research, specific questions that form indicators for the presence of certain mechanisms are included. These questions are open as: "*what characteristics make a company professional?*" as well as closed questions, with true/false answers. These mechanisms are distilled from literature and included in the research, after selection of relevant mechanisms, based on discussions and interviews with experts and growers (Scott, 2007, Hedstrom&Swedberg, 2006). Initial mechanisms that are included are:

   a. *Conscious imitation (strategy)*
   b. *Isomorphism/cultural coherence*
   c. *Conformism vs. doing things differently*
   d. *Rational economic decision vs. interpretivism*
   e. *Urge to innovate vs. resistance to change*
   f. *Insecurity and regression vs. revolution in harsh times*
   g. *Rejection of outsiders vs. believe in outside help*

The mechanisms where discussed making use of the interview materials. One example is given below, the full document can be found in attachment 11.1.5.

Insecurity and regression *Vs*. Revolution in harsh times	What is the best time/moment to innovate?	open
	I feel the urge to fall back on old strategies and routines in time of uncertainty	True/false
	Only in times of prosperity, there is room for innovation	True/false
	Especially in times of crisis, I am willing to change/innovate	True/false
	It is not wise to try new things in difficult times	True/false

Table 4 - Questionnaire example on social mechanisms

Overview interview materials:

In the Table 5, an overview is given on the used interview materials, explaining how the materials are used in conversations on innovation practices. In te right column, the numbers corresponding with the attachments are provided.

Title of material	Subject of study:	Attachment:
Social background	Some background information is needed, as the characteristics of the respondents are often used as variables in explanations on social behavior. For example, the age, sex, and level of education may be useful variables that help to explain decisions or actions.	11.1.1
Investment categories	In the beginning of this research, I have categorized the investment strategies (some being innovation strategies) into the four strategies of competitions, as identified in the SIGN book. These may not be categories the growers themselves would use. The discussion on how they would classify the investments, helps to understand how growers may chose for an investment based on these classifications.	11.1.2
Investments and innovations in the organization	Investments, some identified as innovations, should not just be discussed on conceptual level, but also related to the organization of the growers. A document was added that could guide the conversation on the history of investments and innovation in the greenhouse, identifying specific innovations and the change over time.	11.1.3
Investment decision strategies	After the investments in the organization of the grower are identified, the decision strategies are discussed. Questions on social institutions, personal preferences, cooperations with other growers, etc. are used to gain a better understanding how the growers make their decisions on investments.	11.1.4
Social mechanisms	Some social mechanisms of decision making as identified in the used literature are included in the interview material. The questions in the table help to identify social mechanisms in the decision making of growers.	11.1.5
Analysis on investments	A document was added with questions that help to guide the discussion on specific innovations, to get a better understanding of why the specific innovation was picked, and how social institutions, personal values, influenced the decision on it.	11.1.6
Timeline	A timeline guiding the discussion on the life history of the growers, and sequencences of occurrences.	11.1.7

Table 5 - Overview of used interview materials

The interviews are semi-structured in the sense that the interview materials are not guiding the interview per se, but are used in the interviews when they are useful. The value of the open conversations is that also those elements not included in the interview material can be discussed, which is valuable in exploratory research. The conversations are therefore flowing, allowing the growers to tell their stories in their own way, now and then asking questions to guide the conversation towards to subject of this thesis. The outcomes of the interviews may therefore differ quite a bit per respondent, and cannot one on one be compared with each other as would be possible when the interviews would be fully structured. The coding of the material, identifying variables, studying the patterns and relation between them, do provide insights in the innovation practices. Insights obtained in previous interviews and also assumptions made by the researcher, may be used in later interviews, enabling the 'testing' of statements and assumptions.

Review on institutions

Institutions are obviously an important element of this research, and will therefore be researched independently. The institutions in this section include the regulative institutions, as rules, laws and subsidies on local as well as national and EU level. Most of the data will be obtained by expert interviews from the horticulture sector, the municipality and LTO Glaskracht, who advocates for the horticulture sector. Additionally, policy documents and historical documents are used to gain understanding of the important institutions and changes within these institutions.

Focus	Methods
Local regulations	Interview municipality + document reviewing
Important national/European regulations	Interview with LTO glaskracht/municipality
Subsidies	Interview with LTO glaskracht/municipality
Relational	Expert interviews
Lobbying activities	Interview with LTO glaskracht

Table 6 - Methods for studying formal institutions

4.4 Data structuring

In this research, ethnographic data will be used to explain innovation practices in the horticulture sector. The data produced in ethnography is in general a mess. It is a combination of written interviews, recordings, documents and personal notes. Structuring, analysing, interpreting and presenting the data is therefore an important step. The richness of data from ethnographic studies can be ordered in programs like Atlas.ti, and will in this research be used to structure, code and guide while analysing fieldwork material. Structuring data in one program, and coding and sub-coding all forms of metarials, helps to bring not only all data in one location, but also structures it to content.

By structuring the data by coding the materials, is already the first step of analysis, as codings are created and applied. The creation of list of coding, code-relation networks and analysis of patterns in the research by the researcher is a core aspect of analysing fieldwork data. Moreover, when coding and reading trhough the material, the creation of memo's is an important task to build up a stock of findings that can be used for the analysis. The codings, comments and memo's that are created during the reading, structuring and coding of materials is the basis for finding patterns, and are the main input for the analysis. Programs as Atlas.ti can falicitate the exploring the data and extracting patterns from it. These patterns can again be validated in new fieldresearch or discussions with experts.

Atlas.ti

A program that helps centralizing data in one database, guide the structuring and coding of material, and provides a good setting in which analysis on patterns in the material can be done, is Atlas.ti. Material as documents, photos, recordings and other material can be uploaded and linked in the program. The core function of Atlas.ti is the coding of data. Material, like interviews, can be coded and structures document based on their contents. This provides material that can be easily sorted and related based on codes. The codes correspond with variables.

Variables are core elements in social science, and serve to find relations and patterns: "*Social research is based on defining variables, looking for association among them, and trying to understand whether – and how- variation in one thing causes variation in another*" (Bernard, 2006). In this research, the analysis is qualitative, making use of ethnographic materials. The process of structuring will therefore be based on coding the materials. The codes are defined by including the core aspects that are used in the research questions, appear from interviews, and emerge while coding of interviews. An important aspect of coding in inductive research, is that the pre-assumed codes and relations do not lead to search for those relationships. Rather, if unexpected topics reoccur, these should be taken into the coding. In that case, the former coded interviews, should be read again, and the new code should be added where needed.

The coding and the patterns that can be observed during the structuring process in Atlas.ti is a core step in the analysis. Insights, observed relations and patterns should be written down in memos in Atlas, which can be coded as well. The insights gained from the set of materials, form the feed-in of the ethnographic analysis. Atlas.ti has the function of Network creation, in which the codes (variables) – identified in the documents in the research file - can be used to create a network. The relations between codes have to be defined by the researcher, which should result from the interviews with the respondents. The identification of codes that are the variables of the research, and the networks in which the relation between the codes is described can just as well be done on paper, which I have done. The analysis of the codes is therefore completely dependent on the researcher. Much of the networks and relations were sketched on paper and in notes. To give some insights in the process, the codes as identified in Atlas.ti are listen in Attachment 11.3.1, and two networks are rebuild from those made on paper in Attachments 11.3.1 and 11.3.2. The networks show how the variables as identified at the end of the coding of all interviews, are used to explain the relation between them.

4.5 Analysis

The analysis is not such much one moment in the research, as it already starts at the moment the ethnographic fieldwork has begun. The analysis is based on grounded theory, which means that the identification of categories and concepts that emerge from the text are used as input for the analysis, linking the concepts into substantive and formal theories (Bernard, 2006). The process of analysis based on grounded theory consists of several steps:

a) First, transcripts are made from the interviews and conversations
b) Then, while reading through a small sample of text, analytic categories, or potential themes are identified. In attachments 11.3.1 the list of codes as used in this study is provided.
c) When the themes and variable emerge, those sections can be pulled together using Atlas.ti, after which all that has been said on the topic can be compared
d) The relation between the categories should be studied and identified. In attachment 11.3.2 and 11.3.3 the analysis of two interviews are shown, to give some insight in the process.
e) The identified relations should be used to build theoretical explanations, potentially using existing theory
f) The analysis should be presented using exemplars, which are quotes from the respondents that illuminate the theory (Bernard, 2006).

During the fieldwork and the coding, assumptions and analysis can already be made, and are based on interpretative analysis, which is dependent on the researcher doing the field work. The personal notes and recordings are therefore central: "*The key to making all this work is memoing. Throughout the grounded-theory process, you keep running into potential hypothesis and new directions for the research*" (Bernard, 2006: 492). Memos are created during the process of structuring and coding the data, and are used to remember important insights by the researcher when going through the data. The memos are important input in the analysis the fieldwork, and to identify hypothesis and suitable social mechanisms to explain the patterns. Some examples of these memos can be found in attachment 11.3.4.

This process of identifying variables and relations between them is a continuous process during the ethnographic fieldwork. It continuously builds upon identified variables and assumptions on their relations from preceding interviews, testing them in later interviews. These assumptions are often captured in memos during the coding process, interviews or any other moment. The analysis therefore is an iterative process. The last step of the analysis is identifying the most suitable theories to explain the patterns. In this thesis, theory on social mechanisms will be used to explain *how* dynamics occur, *through which processes*. This allows explaining 'the specific by the general'; the observed patterns in the horticulture sector with more general theory that gives insights in human action.

Although the types of explanations are predefined with the bathtub model of Coleman, the theories themselves emerge from the analysis of the data. The three types of mechanisms, as discussed before, are:

1) *Situational mechanisms*: analysis on how macro events or states influence individual behavior.
2) *Action-formation mechanisms*: how individuals assimilate the impact of micro-level events
3) *Transformational mechanisms*: how a number of individuals create macro-level outcomes through their actions and interactions

This framework provides also the structure to the social analysis to this thesis. The social mechanisms are used to explain what is distilled from the empirical research and can be used to explain emergent properties resulting from the agent-based model. Therefore, the mechanisms used in this research will not be discussed until the actual analysis of the information obtained in the fieldwork.

4.6 Modeling with MAIA

The MAIA methodology facilitates all steps of simulation development, ranging from system analysis to detailed design. It provides guidance for conceptualizing and analysis for a system, built on theoretical writings on AID model of Ostrom. The methodology provides also applied guidance to the extent of detailed design and semi-automatic implementation of guidelines. Building a full model is outside of the scope of this research, but providing the right information for a MAIA model description is not. Some steps need to be taken before fieldwork data can be used in model descriptions and codes. The empirical research is therefor tied to the end-purpose of the information. In this section, the characteristics of the MAIA model are described, and the implications it has for the research and fieldwork preceding a model description.

Explicit model conceptualization, as in the case of MAIA framework, involves describing the set of concepts that constitute the “building blocks" of the model, as in the case of MAIA taken from the IAD framework introduced in chapter three (Ghorbani 2012). This means that some core assumptions and prefixed containers that can be filled with types of information are already present in the model. The basic description of a model “is generally recognized to be a crucial step in building software models because it leads modelers to better capture, analyze and understand what they are actually modeling” (Winograd et al. 1996). Working with the MAIA model thus means that the meta-model, the formal description of the set of concepts, is given. Ghorbani addresses the issue that most meta-models include only very little social phenomena and can therefore not produce models that are resembling to real systems, humans and behavior (Ghorbani, 2012). The MAIA metamodel created by Ghorbani allows the inclusion more cultural elements as norms, shared strategies, and rules, making use of the IAD tool that was developed as a tool to grasp human behavior and understand outcomes of social action and interaction.

Some criticize the use of meta-models, as it fixes the possibilities of including social richness. The other side of the issue, is that other proposed meta-models are so close to programming language that they fail to reach the broader community of social scientists (Iba et al, 2004). The MAIA model is an attempt to both adhere to the need of social scientist by providing a program that helps building the model, and as well to include enough concepts of social systems to be able to approximate real social systems for modeling purpose. Ghorbani provides both guidance in producing executable code from a conceptualized model, as well as the web-based software that is supports the conceptualization process of the model (Ghorbani, 2012). It is important to recognize the prefixed assumptions made in the model, and the effect this has on modeling. As a result of this research, a reflection will be written on both the convenience of the meta-model, as well as the friction that may occur between the meta-model and the richness of information and analysis resulting from empirical field research.

The meta-model

The building blocks as given by the IAD framework are used to build the MAIA framework that can be seen in Figure 8. The institutional analysis is based on the use of different building blocks that can help describe diverse and regularized institutions. Institutions are defined as “the set of rules actually used by a set of individuals to organize repetitive activities” (Ostrom cited by Ligtvoert et al, 2010).

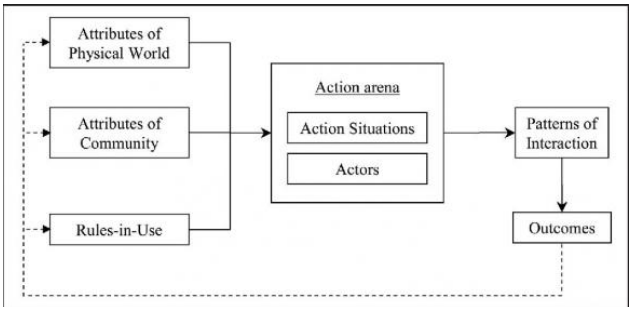

Figure 8 - Building blocks of the IAD framework

The framework consists from system characteristics, the action arena – called operational structure in MAIA – and the 'outcome' of the social behavior, called 'evaluation criteria' (Ghorbani et al, 2012).

The model allows for descriptions on system level, as physical structures, basic constitutional structures and collective dynamics, as well as more detailed descriptions on specific actors. Actors, named agents in models, can be described by their state variable, perception, decision making, roles, physical attributes and relationships. It are these variables that make the MAIA model richer than most other models, by providing more room for culture, non-economic behavior and differentiation between actors. Additionally, it is able to show the emergence of social institutions from actors that can be described in more detail, giving room for more realistic characteristics and mechanisms of social systems.

Some larger structures can and should be described in the model, to be able to describe the system well. Therefore, some social structures need to be explicitly described and implemented in the model. However, the value of the model is that patterns and social structures are likely to emerge from the action and interaction specified on individual level (Ligtvoet et al, 2010). The power of the model is that some of the emergence of social phenomena can be produces and explained by what happens on individual level.

The blocks as present in the MAIA model are shown below in Table 7. The blocks and properties that are present in the blocks form the meta-model of MAIA. The properties are fixed, which means the specifics of the system comes down to how those properties are described: which actors are important to the growers in the Westland sector? What roles do they have? What action situations are there, and when do agents act from the different roles they can take? Which physical aspects of they use?

	MAIA Blocks	*System elements*	*Attributes*	*Value adding*
	Collective structure	The actors and their attributes	- Types of actors	- Broader conception of agent (Scott)
			- States of actors	- Realistic agent descriptions (ethnography)
			- Perceptions of actors	- Relations, dependencies and power
	Constitutional structure	Social concepts and relations	- Roles	
I. System components			- Objectives	
			- Dependencies	
	Physical structure	Physical aspects of the system	- Materials	
			- Energy, Money	
			- Technologies	
			- Physical connections	
	Operational structure	The mechanisms and workings of the system	- Actions	- Social and economic mechanisms underlying behavior and change
II. System dynamics			- Action arena's	
			- Action situations	
			- Action sequences	
III. Model evaluation	**Evaluative structure**	The concepts that are used to validate and measure the outcomes of the system	- Problem domain	- Empirical data and social mechanisms explaining emerging patterns in model
			- Validation	

Table 7 - System elements overview

The MAIA framework does not only provide a metamodel as can be seen in Table 7, it also provides a method to distill the institutions from the used materials as interviews as documents. These social institutions that are central to this thesis, are part of the Constitutional structure. In the next section, I will discuss the ADICO principle, which I basically the method to extract the social institutions from the material.

ADICO

With the creation of the MAIA model in hindsight, some of the coding should be done according the ADICO principle introduced by Ostrom and colleagues that forms the basis of coding regulations, norms and strategies in the MAIA model. The ADICO perspective does not give a deviating perspective on what norms, strategies and

rules are, but provide guidelines in how these institutions can be distinguished from each other. Because norms, rules and strategies have the same format (consist of the same components) they can be modeled easily.

Ostrom's *Understanding Institutional Diversity* (E. Ostrom, 2005) and *Institutional incentives and sustainable development* (E. Ostrom 1993) provides guidance in translating the observations in the ethnographic research into a syntax that is appropriate to reflect the insights leading from the fieldwork, as well as being suitable for a model description. The Institutional Analysis and Development framework (AID) that Ostrom has developed in cooperation with Crawford (Basurto et al). In 1995, the two authors proposed a grammatical syntax for examining institutional statements, as rules, norms, values and strategies. This ADICO syntax will form in important foundation for my framework which helps both to recognize and label social institutions. These social institutions are "*shared concepts used by humans in repetitive situations organized by rules, norms and strategies*" (Ostrom, 2007).

Crawford and Ostrom have developed an approach to distill these institutions from the social world, based on the assumption that they can be found in spoken or written language.These "institutional statements" are defined by Crawford and Ostrom as *"…the shared linguistic constraint or opportunity that prescribes, permits, or advices actions or outcomes for actors (both individual and corporate). Institutional statements are spoken, written, or tacitly understood in a form of intelligible to actors in an empirical setting*".

The repetitive elements that make up these linguistic institutions, as the authors state, are the core of the ADICO syntax, and fit across all scales of social institutions and actors. However, a problem arises here, as the institutional statements do not uniformly lead to the actual social institutions. The first difference is that the codes distinguish norms, values and rules in a concrete way, as in the social world, the boundaries may be more blurry that the coding indicates. The second difference is that not all social institutions can be distilled with the framework, since not every social institution can be articulated, and traced back in linguistic statements in the form of speech, written documents, or tacit understanding of actors. The consequence of the framework is that the more conceptual or abstract institutions may not be included (Crawford and Ostrom, 1995).

The three types of institutional statements that can be found in the 'action arena' are; rules, norms and strategies. The ADICO syntax is built from five sub-components, being:

- Attribute (A) *The individual or organization to which the institution applies, and the description of the subject(s.)*

- Deontic (D) *The prescriptive operator of an institutional statement that describes what is ideally permitted, obliged, or forbidden, and can be found in implicit forms as: may, must and should. Despite the difference in prescriptive force, are taken as the same force in the framework.*

- Aim (I) *The goal or action of an institutional statement that the Deontic refers to, as a description on what action or how an action should be conducted.*

- Condition (C) *The condition represents the operations "when" and "where" for which the aIm is allowed, required or forbidden. Also "if" and "unless" are two other terms that direct to a condition that sets a prerequisite or restriction for the aIm.*

- Or else (O) *The Or else operator is the punitive action if the rule is not adhered.*

Applied to the sentence *"You must lock the door to the house or I'll be angry with you"* the coding would be applied as the following:
You (A) must (D) lock the door (aIm) to the house (C) or I'll be angry with you (O)

Three types of institutional statements can be formed, based on different combination of sub-statements:

Rule: ADICO; *"I should lock the door to the house or you'll be angry with me"*

Norm: ADIC; "*I should lock the door of the house*"

Strategy: AIC; "*I lock the door of the house"*

As discussed in the beginning of this chapter, the MAIA model should be filled in according to the available building blocks, containing attributes (Table 7).

4.7 Conclusion

The four central steps of this thesis are the ethnographic fieldwork, the structuring of data, social analysis using the bathtub model of Coleman, and the creation of an agent based model. The ethnography and agent-based modeling are of different epistemological nature. In my fieldwork, empirical knowledge is obtained on the social system 'out there', assuming that the world can be understood through direct observation and interaction. The knowledge is produced through participatory observation, interviews and group discussions, providing a large body of data on the actors studied. The researcher has a special position in this step, as I am the 'instrument' collecting and interpretation data, which is typical for anthropology. However, through the ordering of this abundant data with Atlas.ti, patterns and differences can be found in a more structural way. This ordered data that will form the input for my analysis.

The social analysis is framed with the bathtub model of Coleman. I showed how I will explain the influence of social institutions on innovation practices through the three steps and corresponding mechanisms. This research step is about providing actual explanations on the *processes* that create patterns and dynamics in the system. The underlying assumption is that the influence of social institutions on innovation practices can best be clarified through the three steps of the bathtub model, studying individual action to understand system dynamics. This step forms the actual explanations in my thesis and draws upon the empirical data produced in the former step. The methodologies underlying these steps are systematic analysis of the ordered data, after which suitable explanations are found to explain the patterns and dynamics found. This way of creating knowledge is identified as 'grounded theory'. The mechanisms with explanatory power that are used to understand the social phenomena are found in relevant literature.

The last step, the creation of a model, is realized through the metamodel named MAIA. This model provides the overall social concepts I can work with to describe the studied social system of the Westland. In my thesis, I will build the model description, by filling the metamodel with the finding of my preceding steps. This process will provide insights in the way the two different methodologies (and epistemologies) may fit together or, clash. The agent-based model may be used in further research to study the digitally described social system, providing the possibility to play with it and explore the dynamics of the system. The study of system dynamics with a model in which the actors, relations and institutions are described is called generative science, based on the assumption that knowledge can be obtained from the emerging phenomena in such a model.

In this chapter, I have discussed the research set up and corresponding methodologies. In the next part of this thesis, the outcomes of my empirical research and social analysis will be discussed. The second part of my thesis consists of three chapters that correspond with the three steps of explanation as in the bathtub model of Coleman. Subsequently, in chapter four the dominant institutions and their influence on individual growers are discussed. In chapter five, I use five examples of growers to explore the decision making strategies leading to investments. In chapter six, I provide explanations of system level phenomena using transformational mechanisms.

Conclusions

Problem statement and angle

- This thesis addresses the dominant use of certain innovation strategies in the horticulture sector, which has been linked to the current economic problems.
- These innovation strategies relate to the underlying strategies of competition as defined by Porter, and studied in the sector by Marco Hekkert and Leon op de Beek/SIGN.
- The four strategies of competition that will be used in this thesis to understand the main differences in organizations and strategies, are the more dominantly present *cost leadership strategies* (cost-reduction & volume-increase), and the rare *differentiation strategies* (activity-extending & value-adding strategies).
- These strategies of competition provide insights in the social embedding of the organization as the strategies carry underlying logics, criteria for success, focus and acquired activities of horticulture organizations.
- The hypothesis of this study is that the organizations and innovation practices are socially embedded, in a sector structure, in organizations, people's routines, strategies, believes and in skills of employees.
- This research studies this *social embedding* of organizations and innovation practices.

Theoretical approach

- Innovation in the horticulture sector is approached from a social perspective, taking the actors, their choices, strategies, actions and relations and subject of study.
- Innovation is studied as a new variation of social expressions: "*innovation occurs on the level of social behavioral patterns, routines, practices and settings".*
- The relation between the individual and the system, or more specific, individual decision making and the power of institutions, is the subject of study, thereby continuing to the central sociological debate known as the 'structure and agency' debate.

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- The relation between the individual and the system, or more specific, individual decision making and the power of institutions, is the subject of study, thereby continuing to the central sociological debate known as the 'structure and agency' debate.
- The bathtub model of Coleman on the theory of action is chosen as the most suitable framework to understand how different societal levels relate to each other, and therefore how the effect of social institutions on innovation practices can be studied.
- The methodology of *grounded theory* is used, which means that the framework is not operationalized before the fieldwork starts. The variables and hypothesis emerge from the analysis of the data, using theory to explain the patterns found in the data.
- These 'building blocks' of the IAD framework are used to predefine some core elements that should be studied in the fieldwork, to ensure the required data at the end of the fieldwork.

Methodological approach

- Knowledge on the social system 'out there' in the Westland is obtained through ethnographic fieldwork. This knowledge is produced through participatory observation, interviews and group discussions, providing a large body of data on the actors studied.
- The abundant data is structured, coded and analyzed using in Atlas.ti as the software to do so.
- The analysis is based on *grounded theory*, explaining the relations of variables with theory on social mechanisms.
- A agent-based model description will be made, using the findings obtained in the ethnographic study to fill in the metamodel provided by MAIA. The ADICO typology guides the identification of social institutions.
- The process from ethnography to a model description are expected to provide insights in the way the two different methodologies (and epistemologies) fit together or clash.

part II

Fieldwork outcomes and analysis

In the previous chapters, I have defined the problem statement and introduced the theoretical framework and methodologies used in this research.
The Coleman bathtub model was presented as the central model guiding the study on institutional influence on innovation practices.
The model is based on three steps of explanation: macro-micro mechanisms giving insights in how institutions affect individuals, micro-micro mechanisms explaining the action-formation process at individual level, and micro-macro mechanisms, explaining the emergence of system level patterns from individual activities.
In this part of the thesis, the outcomes of the ethnographic fieldwork will be discussed, using the bathtub model from Coleman as the core framework.
The three chapters correspond with the three steps of explanation as used in the bathtub model. In chapter 5, I will address the institutions affecting individuals, discussing both formal as informal institutions. In chapter 6, the decisions and innovation activities of individual growers are discussed, taking five stories of growers as illustrating examples. The effects of individual activities altogether, giving rise to system level phenomena, will be discussed in chapter 7.
I will conclude this part with a discussion on some overall patterns and dynamics as found in the system. It provides exploratory research.

5 Situational mechanisms: social institutions

II

5.1 Introduction

In this chapter, I will present the findings of my research on the first step of explanation from the bathtub model: the impact of social institutions on individuals. The first section deals with some important rules and regulations of formal nature that are embedded in official organizations and written documents, like regulations, agreements and fines. These rules and regulations influence the way that growers innovate. Insights are obtained on how the decision space is affected by institutions, and how social structures and institutions determine both the restrictions as well as the opportunities for individual growers (Giddens, 1984). The duality of the restrictions and opportunities institutions provide for innovation practices will be taken as a point of departure. Studying the effect social institutions have on individual growers, forms the first part of the explanation of the bathtub model, illuminating how the macro-level (institutions) affects the micro-level (individuals). These mechanisms are of 'type 1', as indicated in the bathtub model.

In the second section, social institutions are discussed that are embedded in the Westland culture, as a shared understanding of how things are done or valued. These social institutions are not formal, but may exert power over individuals through social pressure of community members, and are also of 'type 1'. Moreover, shared strategies and routines that are customary and often automatically performed procedures or activities are discussed. These ways of dealing with situations are often based on shared strategies, creating patterns in horticulture practices in the sector.

5.2 Formal institutions

Formal norms differ from informal norms in the sense that they are enforced by specialized agents who typically impose direct punishment on the violator, rather than ostracism or shaming (Elster, 2007). These institutions exert power via the consideration or 'fear' of such punishments. My research on formal institutions affecting the decision making of growers, is based on interviews with growers and experts, as well as document research. In the interviews with the growers, the most influential organizations and institutions could be identified. Interviews helped to give more insights on the institutions, their power, and consequences in case of violation.

Some institutions are formal written regulations, while other institutions are embedded in economic mechanisms or in subsidies - exerting power in other ways. Examples of formal institutions are the regulations set by the Dutch government, mainly enforced by the municipality, which apply to all growers. The same holds for the regulations set by the NMA. When growers break the rules of the government or the NMA these violations are often followed by judicial steps. In the case of regulations from the municipality or NMA, there seems to be no choice involved. Still, growers can choose to violate regulations, accepting the risk of punishment, as the case studies in the next chapter will show. Some other formal institutions are conditional, in case a grower enters an agreement, such as a finance agreement with the Bank or an investment subsidy from the European Union. In those cases, a grower signs a contract in which he accepts the rules tied to the money he receives. He has to make a balanced decision – carefully considering the advantages and disadvantages of his decision. This part of the chapter will therefore provide insights which formal institutions growers are mostly dealing with when deciding on investments.

In the next sections, six prominent actors in the horticulture sector are discussed, together with the formal institutions they exert. These institutions were identified in interviews as being influential in decisions on innovation strategies and thereby in investments of growers. The influence the institutions might have is described, explaining what the impact of the respective institution means for the individual growers .

5.2.1 European Union: GMO

EU agricultural policy ensures that European food security goes hand in hand with economic measures and healthy rural communities around environmental issues such as climate change, waste management, water management, bioenergy and biodiversity (website EU). One of the most influential policies of the European Union on the Dutch horticulture sector is the GMO subsidy. Since 1996, producer organizations, and thereby indirectly growers, may recover half of the investment and the additional costs at the European Union (EU) to improve their market position (PT Handleiding). The subsidy is meant to support European farmers and growers by covering 50% of their investments in new technologies are prescribed by the EU. The GMO subsidy, abbreviation for *Gezamenlijke Markt Ordening* (collective market structuration), was created to encourage growers to join together in cooperations with a uniform brand.

In the interviews, almost all respondents agreed on the huge influence the GMO subsidy has had and still has on the Dutch horticulture sector. Firstly, because the subsidy enabled growers to innovate for a much higher amount of money, as the subsidy covers around 50% of the investment. This led to higher investments in innovations, primarily in technologies such as CHP's (Combined Heat Power stations) and box packing machines. Secondly, growers have joined cooperations in order to be eligible for the subsidy, which influenced the structure of the sector significantly: "*Trouwens, al die telersverenigingen zijn ontstaan door GMO. Als je geen telersvereniging bent, krijg je geen GMO*" (Source: interview with expert). Thirdly, a condition for the subsidy is the uniformity of the products; in order to be eligible it is not allowed for individual organizations to employ their own brand names and marketing strategies. This thereby forms a barrier for marketing innovations at the individual level, as these are streamlined through several large sales organizations. At the same time, the investments in other innovations as the example of CHP's are stimulated by the subsidy. Altogether, the subsidy has a multiple and serious effects on the sector overall despite its reputation, so how can the power of the subsidy be explained looking more closely at its implications for individual growers?

Effect on growers

> *"De structuren hangen af van GMO, het heeft veel invloed op de verkoopstructuren waar we nu in werken. Het is zo dat onze cooperatie bijna ondergesneeuwd wordt door dat klote GMO. We willen eigenlijk onder de verkooporganisatie een aparte dochter onderneming zijn, maar met GMO kon dat niet meer"* (from: interview with grower respondent, 2012)

The quote illustrates the contradictory attitude growers have towards the GMO subsidy. On one hand, the subsidy helps the growers to finance their investments, but at the same time the subsidy is heavily criticized because of its negative effects on both individual and sector level. The critiques named by the respondents in the interviews are plural, despite the fact that most of those growers do benefit by this 'free money'. This tension between the disapproving opinions of the growers and the common use the subsidy tells us that the institution has a considerable power: growers make use of the subsidy, although they fiercely criticize its existence.

An explanation of the power of the GMO subsidy lies in the harsh cost-price competition. This competition makes the decision to ignore the subsidy very risky, as the investment in one new technology may make the determining difference in cost-price compared to a competitor that does make use of it. This effect of the subsidy is even stronger as the subsidy is at European level, which means the growers are competing with international growers that can also apply for the GMO subsidy.

A marketing expert involved in a large cooperation and in her husband's grower organization explained how the GMO subsidy is almost inevitable for bulk-producing companies. Moreover, she explains how it affects the potential for marketing:

"*Er zijn weinig groentetelers die geen GMO subsidie nemen omdat ze anti zijn, dat kan bijna niet. De hele wereld draait er om. Het bedrijfsproces wordt beinvloed omdat je makkelijker dingen kunt kopen, maar in het marketingproces is GMO wel ingewikkeld. Je krijgt namelijk alleen maar GMO als het generiek is en bij marketing wil je juist niet generiek zijn. Dat is een spanningsveld*" (Rokien Schenkeveld, 2012).

Her quote illustrates a dilemma for growers who would like to employ own marketing strategies, as this is forbidden by the EU in case the GMO subsidy is used. It means that innovations increasing the product value cannot be employed by GMO-users, or that those choosing to use own branding a) risk a fine or b) have to reject the GMO-subsidy. This dilemma directly influences the decision for investments, as is the many cases of growers receiving the subsidy, marketing and other value-increasing innovations are out of the question.

However, as influential as the subsidy seems, not all growers use GMO, as some growers are not connected to the official sales cooperations. Examples in my research are small greenhouse enterprises acting independently in a niche market and one grower of a large organization that has made the conscious decision not to apply for GMO subsidy to avoid the conditions tied to the agreement. In these cases, the growers do not receive the benefit of having 50% of their investments covered, but they do still have the freedom to sell their products under own branding and marketing strategies. As described above, both applying and not applying for the subsidy has considerable consequences for growers, and the risks and benefits of the GMO subsidy are recognized by most growers. This means that although the GMO subsidy is criticized by most respondents, the great majority of growers acknowledged they do take the subsidy. How this ambivalent attitude to the subsidy may seem irrational, but can often be well explained from the perspective of a grower. These decision mechanisms will be discussed in chapter 5, using the stories of growers.

Summarizing, the influence GMO subsidy has on a grower is that he has to make a conscious decision on whether to apply for the subsidy or not, in both cases accepting advantages and disadvantages. When taking the GMO subsidy, the conditions the EU poses have a determining influence on how the grower can cooperate and excludes the possibility of having an own brand and having marketing activities. Moreover, the grower starts an agreement with the EU, which he will be held to, risking fines when violating it. When rejecting the GMO subsidy, the grower is affected too, as it creates a disadvantage in terms of investment possibilities compared to peers that do make use of the subsidy.

5.2.2 Regulations: the municipality

The municipality has the role to supervise municipal regulations and to punish violators, but also to facilitate organizations and economic activity within the area. The development plan is core to the spatial organization, defining the division between industrial activity and residential areas. Moreover, as inhabitants have different wishes than the large horticulture businesses, the municipality may have a role as mediator. The municipality may both restrict the behavior space of growers, as well as enable it. Important institutions for this study are the regulations that prescribe the room to maneuver in (development plans and regulations on constructions). This holds for (re)building of greenhouses, but also to other constructions being build. Also the environmental and safety regulations determine what entrepreneurs can and should (re)construct, and under which terms.

The regulations supervised by the municipality are aimed at different levels and aspects of horticulture organizations as safety, environmental performance and construction, and are of formal character as they carry high authoritative power. The regulations hold for every grower, are strictly applied and violations can be severely punished. In this section I will show how the regulative institutions from the Dutch regulative body, mainly supervised by the municipality, effect innovation practices.

Effect on growers

The regulations affecting innovation practices can be divided in those stimulating innovative investments and those blocking or restricting innovative investments. One example of regulations stimulating investments is the

rule that says that every grower should have a rainwater basin of 500m3 per hectare. This regulation aims to improve the water management of organizations (interview with employee Gemeente Westland). For those organizations using soil, it was not obliged for a while, but since two or three years it is. Although this regulation stimulated the investment in the water tanks, it has aroused lots of protest of growers that do not acknowledge the usefulness of the regulation for their organizations, which sometimes even led to judicial cases. This specific example shows that regulations may stimulate investments as prescribed, but may not lead to the achieved goal or innovation. Nevertheless, the rule on the water basin has as effect on the *investment decisions* of growers.

The regulation affects the innovation practices of growers, as some investments are obligatory, determining the focus of investments towards a certain direction. This is relevant for the analysis on investments strategies of growers, as in some years, the available money may have to be invested in prescribed goals. The main difference between the investments on the four strategies as identified by Leon op de Beek, is that these commercial investments increase margins in some way, while the prescribed investments by the municipality may solely have the effect of improved safety or environmental impact. A fifth type of investment strategy in this study is therefore an investment that makes the organization compliant to the newest regulations on greenhouses, thereby not employing a specific strategy of compliance.

Some other regulations may rather hold back innovations, as in the case of geothermal development. The quote illustrates that complete new innovations may conflict with regulations that are not yet adapted to new possibilities, as the drilling for geothermal heat:

> "*Meestal gaat het wel in overleg, dat ze kijken wat er kan, bijvoorbeeld bij aardwarmte. Maar er gelden nog instituten vanuit de oude mijnbouwetten voor de aardboringen, die moeten nog aangepast worden. De wetgeving sluit dan niet goed aan. Het is frustrerend als de overheid niet de kennis heeft, dan mag er niks. Dan blokkeert het, dan is de overheid een rem op innovatie*" (Interview with grower).

Another example of conventional regulations forming a barrier to innovation, is in a water sharing system proposed by a group of growers. Similar to the geothermal example, due to a lack of regulations or outdated regulations, innovative trajectories as a shared water system may be retained:

> *"Er komen hier wel eens telers met een heel goed idee, iets innovatiefs, dan past het niet binnen de regels. De Rijkskoverheid zet in voor algemene regels, voor een grote groep, dan past het vaak niet. En als lagere overheid zit je dan in een spagaat, omdat je wil dat telers innovatief zijn, maar als het niet past binnen de regels, kun je als gemeente jezelf niet boven de regels zetten. Dan zit je in dezelfde spagaat als waar de telers inzitten"* (interview with respondent from Westland municipality).

In the two examples, the regulations may lag the newest innovation practices, holding back some innovations by forbidding it or slowing the process down when the regulations need to be adapted.

What is interesting for this study, is that in both examples where investments are stimulated and are slowed down, the regulations of the municipally in general address physical elements of the greenhouse: the employees, the safety of employees, and the water, energy and material flows involved. The municipality does not employ rules to improve the marketing situation. This means that the municipality – or, government in general - addresses environmental sustainability issues in a very practical sense, as incrementally tightening up the regulations, but do not do so in the same way for marketing issues. Although the municipality organizes events as the 'Westland event 2011' - addressing marketing issues to increase value-increasing strategies – rules about physical requirements of greenhouses are more powerful in the sense that they are regulated and may involve punishment in case growers do not invest.

Punishment

Formal institutions as environmental regulations may force growers to invest in adaptions or change activities in their organizations to meet the regulations. Examples are installing and operating shields to reduce light emissions and installations for water treatment. If growers choose not to invest in prescribed requirements for the greenhouse, they may be punished by the municipality.

The municipality employs a range of regulations that apply to the horticulture businesses, ranging from 'smaller' regulations such as the check-up of installed fire-distinguishers, to regulations about discharging of toxic and environmental damaging substances (Interview with an employee of Gemeente Westland). Besides the seriousness of the violation (the risk it gives), the municipality pays attention to the extent to which the entrepreneur is consciously disobeying the regulations. In case a grower cannot invest due to financial difficulties, the municipality may give more time or find another solution.

In Figure 9, the two variables are presented on the two axes. The left lower corner shows the violations that are not so serious, the grower will not be punished, but a letter of diagnose is sent. In the top right corner, the violations are considered serious and consciously done, and are therefore reported and judged according to the Bibob (De Wet bevordering intergriteitsbeoordelingen door het openbaar bestuur). In between, a warning can be sent or a punishment can be given, as can be seen in Figure 9. The severeness of punishment determines the barrier to violate the rules to a great extend, and is likely to be a central element of the decision of a grower to violate a regulation.

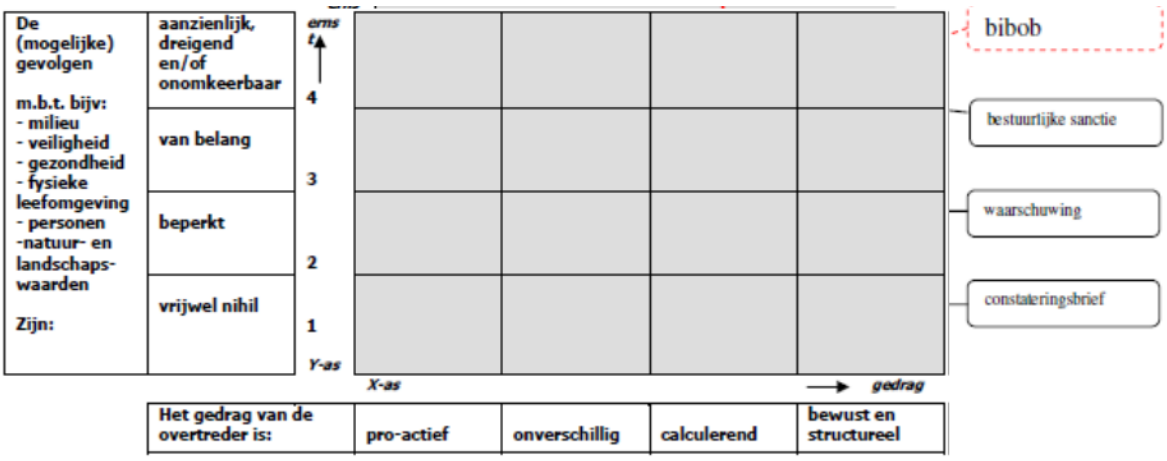


Figure 9 - Punishment strategy of the Westand municipality

Community effect

The region of the Westland is special in the sense that it entails a community in which many members share the same profession and cooperate together very closely. The municipality benefits as well as disadvantages from the close connections amongst growers. The respondent from the municipality gave two examples to illustrate this. The close ties are beneficial when the municipality wants organizations to keep to the regulations more strictly; messages about fines spread around easily. On the other hand, growers will also contact each other to warn each other when assimilation checks are held at night:

> "*Wat dat betreft is er sterke sociale controle. Voor ons werkt het heel goed dat als er iets aan de hand is, dat we bij een of twee telers flink te laten zien dat het menes is. En dan gaat dat op verjaardagen, op zondagmiddag, zo de rondte. Dat is ook een van die krachten van het Westland, die sociale verbondenheid. Maar het kan ook in je nadeel werken. Als we 's nachts die belichtingscontroles gaan doen, dat iedreeen met elkaar rondbeld, van: 'ze zijn die controles aan het doen, doe je schermen dicht'. Dus informatie kan snel de rondte gaan in gevallen dat je het wel wilt, maar ook als je het niet wilt. Er wonen genoeg mensen*

in het westland van onze collega's, zie zitten dan op een verjaardag en horen dat dan. dan heeft hun vader een tuin, of allemaal vrienden, en die hoort het op verjaardagen dan allemaar voorbijkomen, dat is wel een moeilijke situatie".

This quote shows that the effectiveness of regulations is to some extend connected to the social networks of growers. The enforcement of regulations is both facilitated trough the close ties of the grower community, as well as the community has ways to minimize the impact of controls be quickly communicating with one another. Again, this shows the social embeddedness of the sector, and the effects this has on policies used.

5.2.3 Rabobank

The Rabobank is the largest and most prominent bank in the Westland region and likewise, in the horticulture sector. The bank has invested large sums of money in horticulture organizations and is thereby tightly intertwined with the sector. The advisors from the Rabobank - specialized in horticulture organizations - guide growers in their organizations and advise them on financial and strategic decisions. The bank might intervene in originations that are in financial problems. Also, the Rabobank organizes meetings for growers to facilitate the sharing of best practices, and also has a special innovation program and fund.

The bank is increasingly taking an active role in the sector, as the companies are growing in size and dependency of external investments. Additionally, since the financial crisis that started in 2008, the supervision and involvement of the banks has increased, as they are deeply rooted in the sector through large investments in horticulture businesses. Especially those organizations that are in stormy weather are closely supervised by advisors from the bank, who can have a determining influence in decisions. The advisors can have different relationships to the grower as investor, advisor, supervisor and executor.

In an interview with an account manager of large horticulture companies at the prominent bank in the region Westland, some interesting institutions could be identified. In an interview, the analysis of the problem in the sector by an account manager is clear; he does not believe in the current trend of cost-price reduction:

> "*Wij zeggen eigenlijk; als je daar in die kostprijs gaat zitten, daar kom je niet meer uit. die prijs blijft alleen maar zakken en de minimum kostprijs blijft erover. De mensen moeten betaald worden en die tuin die staat er toch, op een gegeven moment kun je niets meer weghalen, dan is het vlees van de botten af. En dan is de vraag; wat kun je nog doen met innovatie? Dan zie je dat er maar hele kleine verschillen worden gemaakt [in de onderlinge competitie]. Wij zeggen; je kunt beter die taart groter maken, in omzet en afzet, dan dat je alleen kijkt naar je eigen taken"* (Account manager, Rabobank)

Despite the analysis that the solutions are not in cost-price reduction but in product value increase and sales, the investments made are predominantly in new technology and scale-enlargement, those investments with material premises. Investments in marketing plans, an important mean to communicate and increase a product's value, are out of the question:

> *"We kunnen natuurlijk niet marketing gaan financieren. We financieren in principe allen maar activa, als iemand een auto nodig heeft, kan hij bij ons leasen, bij productiemiddelen kun je wel financieren, maar je kunt geen hoop lucht financieren: marketingplannen zijn niet voor bankaire financieringen. Je wilt altijd onderpand hebben als bank. Ik denk ook niet dat financiering het moeilijkste is voor marketinginnovatie, maar meer de denkwijze".*

It seems that the preference for innovations that involve technologies - as can be seen among the growers - is also present in the bank. The reason that marketing plans are not accepted for investments is because of the (perceived) risk of those investments, which was ascribed to the lack of experience in marketing of grower and the fact that most growers produce bulk products that are not easy to differentiate and therefore identify by consumers. He explains that this is different for organizations such as Google that are experts on marketing:

"Als je naar andere bedrijven kijkt als Google, daar is marketing een groot deel van de omzet en van de kosten. Als je R&D doet, en aan innovatie en ontwikkeling, daar gaat 20% van de winst linea recta naar nieuwe projecten. De vraag is dan: waarom is dat niet zo in de tuinbouw? Dat is omdat er te lage marges worden gemaakt."

It is interesting that the account manager stresses the same problem on the minimal margins on the products in the sector, but finances mainly the solutions that are cost-price reducing and scale enlarging, thereby stimulating the exact problem he identifies. Further investments in scale-enlargement and process efficiency sector-wide logically lead to higher productions and competition on cost-price. The solution to this is not easy, as the growers are often inexperienced in marketing and stuck in the stringent cost price war. Investments in marketing plans are therefore indeed risky. On the other hand, only the investments aimed at increasing the value of products would solve the actual issue the account manager himself identified.

Another issue that was raised by several growers with regards to the influence of the bank on the sector, was the fact that because of their high investment, financial institutions have the power to either support companies or pull the plug out:

"*Als de bank zegt; het spijt ons, maar in uw bedrijf zit geen rendement meer, we stoppen ermee, dan neemt de productiekant af, en komt er wat lucht op de markt. Maar als ze een bedrijf niet laten klappen omdat er teveel geld in zit, en ze blijven maar douwen en douwen en de markt overvoeren met producten, is dat dan de oplossing? de bank houdt het kunstmatig in leven, dat is een zeer kwalijke zaak*" (interview with grower).

The quote illustrates two critiques many growers expressed in the interviews, addressing the vast power the bank has sector-wide as a result of their dominant position and many clients in the region. The first critique is that overproduction occurs as a result bank policy - which determines when an organization in financial difficulties is continued and declared bankrupt. As the bank has large sums of money fixed in organizations, bankruptcy would mean the loss of capital. The second critique relates to the policy to maintain organizations with large loans, to minimize capital loss from the bank, while organizations with fewer loans are declared bankrupt more easily.

As the bank is a company, such strategies to decrease losses and ensure profits to shareholders are legitimate, as it is to any firm. However, the tension seems to lie in the fact that the Rabobank has such a central position in the sector, and has vast influences on it with its policy. Despite this position and impact, the account manager replied they have no special policy overseeing their overall effects on the sector, but that their policy is focused on individual clients:

"*Daar hebben we geen beleid voor. Dat vragen ze: wanneer wordt een bedrijf overeind gehouden? Een jaar wachten en aankijken helpt vaak ook wel, en tuurlijk zijn er bedrijven bij die weinig vet op de botten hebben, die we overeind houden en bedrijven die met veel vermogen gestopt worden, omdat er dan weinig financiering in zit. Bij die ander zit er veel van ons in*" (Accountmanager, Rabobank).

Effect on growers

The bank policy has effects on individual level as well as on sector level, as was explained in the former paragraph. As this chapter is about social institutions affecting individuals, only these will be discussed here. The effects the formal institutions have on individual growers, are tied to loans and stated in the contracts that are signed. If a grower has large investments from the bank in his organization, he is obliged to report on his company. If his company is healthy, making enough profits, the involvement of the bank can be minor. Only when larger changes or investments are made, the bank has to be informed.

However, the influence of the bank is higher in those organizations that have larger loans and having financial difficulties. In these cases, the bank may take over the control over the organization and decide what happens; indicating solutions or liquidating the organization. These troubled organizations have to pay higher interests and may not receive new loans from the bank, which makes the position of organizations in difficulties more disadvantaged. Those organizations that are financially successful, have more freedom and financial abilities to invest in more risky and unconventional ways, while companies having little finances and under trusteeship are more likely to focus on cost reduction and risk control. This may lead to even further divergence of the prosperous and less prosperous horticultural organizations.

In general, the decision space of growers is reduced when the bank makes use of its authority connected to the large sums of money in the organizations. The involvement of the bank in larger decisions may have influence the choice to invest, and in the type of investment. As explained in the former paragraph, the bank only gives out loans for investments involving security premises. This makes make investments in physical innovations more attractive then investments in marketing strategies. The decision for process-innovations, central to cost-competition strategy, are therefore easier to find funding for.

5.2.4 NMA

The Nederlanse Mededingingsautoriteit (NMA) is the organization that oversees the market and monitors whether organizations in a market are competing conform the free market mechanism (source: website NMA). It is forbidden to form agreements on prices and market shares among competitors, as the free market is affected. The goal of the NMA is to enable free trade to safeguard the availability of cheap and high quality products for consumers, therefore setting the preconditions for free trade and fining those organizations that break the rules.

The vegetable branch of the horticulture sector has been restructuring itself after the auction system disappeared, now dealing with problems of overproduction and products being sold under the cost price. As regulations of the NMA intend to stimulate the free market mechanism amongst growers, they forbid growers to communicate about production and prices of crops. This leads to the 'desired' effect that the competition is centered around products and prices, decreasing the prices of the products for the consumers. However, these regulations stimulate cost price competition and have significant implications on the potential ways of growers to effectively address market issues and sustainability efforts:

> "*De agrarische sector kent een andere dynamiek dan de industrie. Een kenmerk van de agrarische sector is dat er grote prijsfluctuaties kunnen optreden. Er vinden levendige discussies over prijsvorming plaats die voortkomen uit de economische positie van de sector. De margeverdeling in de keten van boer tot supermarkt is een veelbesproken onderwerp. Duurzaam produceren krijgt steeds meer aandacht. Consument en overheid vragen om meer dierenwelzijn en minder CO2-uitstoot. Dat levert vaak vragen op over samenwerking binnen productieketens en de ruimte die de Mededingingswet en de Europese regelgeving daarvoor bieden.*" (website NMA).

The NMA itself is acknowledging that the regulations forbidding collaboration may prohibit organizations in a sector to agree upon shared strategies on sustainability issues. The underlying debate on the desirability of the effects the regulations have, can be seen in the two arguments in the boxes below. Whereas the NMA argues that the free market mechanism enhances the variety and quality of products (quote I.), a grower disputes this reasoning by showing the shift towards a uniform supply of crops determined by their cost-price (quote II). The argument by the grower was articulated by several other growers and LTO Glaskracht, stressing the unbalanced protection of consumers over companies, leading to economic problems in the sector and the selling of products under cost-price.

I. "*Het toezicht van de NMa zorgt ervoor dat bedrijven met elkaar blijven concurreren. En dat ze hun uiterste best doen om klanten aan te trekken en de kosten te beperken. Daarom leveren ze betere en steeds nieuwe producten: de klant krijgt meer kwaliteit. Ze houden ook de prijs lager: de klant betaalt niet te veel*" (website NMA).

II. "*Die tuinder is niet gek, die wil overleven, en gaat steeds efficienter produceren om die prijs te kunnen bereiken. Het effect daarvan is schaalvergroting, maar ook dat het product gelijkvormiger wordt. Die consument die baalt daarvan, dat zie je in de continue prijsoorlogen bij concurrenten. Omdat de producten zo gelijkvormig zijn geworden, is het alleen nog mogelijk voor de supermarkten om op prijs te concurreren, en niet op unieke eigenschappen van een product. Dus: steeds gelijkvormiger, steeds meer prijsdruk op de producten. Ik ben er ten diepste overtuigd, dat dit een cirkel is die uiteindelijk nergens toe leidt"* (source: Interview Jos Looije)

The two quotes illustrate that there is no consensus on the way a healthy market can be created in which a variety of affordable and high-quality products are offered. While the NMA stresses the need for free competition – drawing upon the natural market mechanisms (which is dominantly cost-price competition in the Westland), Jos Looije explains that the current mechanisms lead to the contra-effects. His argument addresses impoverishment of the market in which prices are the dominant variable for production, trade and purchasing. Jos Looije suggests innovating outside the cost-leadership strategies, thereby being able to obviate the price war. However, for the many organizations reliant on solely cost-leadership strategies, cooperative strategies forbidden by the NMA are more problematic. How the formal institutions by the NMA affect the growers, is explained in the next section.

Effect on growers

The NMA determines whether a cooperation between growers is legitimate or should be classified as 'economic concentration' (see Figure 10, Box on Cartels). If the cooperation is considered as a collaboration frustrating free competition, the consequences can be enormous, as the newspaper article reported on the paprika cartel. The fine consisted of 14 million euro's. These fines are so high that they may be insurmountable for organizations. The institutions by the NMA are therefore very powerful, as the punishments are extremely high. The effect of these institutions is determining for the possibility of growers to discuss on volumes and prices. This means that growers cannot adjust their production, as crop choice, volume or selling price to arrive at a production that does not exceed the demand disproportionally. The institutions therefore deprive the growers the possibility to organize a shared strategy to overcome overproduction or market prices dropping under cost price.

The membership to a larger sales cooperation does open up some possibilities for closer cooperation, especially in the sales part, though the organizations still have to act as independent economic entities. The membership of a sales cooperation that receives GMO subsidy, also has the effect that the connected greenhouse organizations cannot use own marketing strategies. This means that the combination of the institutions tied to the GMO, and those by the NMA have a larger effect together. Not being connected to the cooperations leave an organization with little means for shared strategies, but the membership of cooperation often brings along the regulations tied to the GMO subsidy. This dilemma makes the decision to employ value-increasing marking strategies as independent organizations even more challenging.

a. "*Uit de door u overgelegde informatie begrijp ik dat de kernfunctie van de coöperatie bestaat in het* ***optreden als verkoopkantoor voor de afzet van glasgroenten van de bij haar aangesloten leden.*** *(U heeft medegedeeld dat de verkoop van de afzet van de telers plaatsvindt voor rekening en risico van de telers; daaruit maak ik op dat het* ***optreden van de coöperatie als verkoopkantoor i.c. op een agentuur-, althans bemiddelingsverhouding berust.****) De telers zijn* ***zelfstandige*** *en* ***onafhankelijke*** *ondernemingen en het feit dat zij hun afzet of een belangrijk deel daarvan via de coöperatie leiden brengt daar naar mijn inzicht in beginsel geen verandering in. Het komt mij dus voor dat zij voor de toepassing van de Mededingingswet in beginsel niet kunnen worden aangemerkt als een onderdeel van één enkele economische eenheid onder leiding van de coöperatie. Het lidmaatschap van telers van de coöperatie dient mededingingsrechtelijk mijns inziens gekwalificeerd te worden als een vorm van samenwerking tussen de ondernemingen … Met inachtneming van het bovenstaande concludeer ik dat de toetreding van de telers tot de coöperatie niet gekwalificeerd kan worden als een concentratie in de zin van artikel 27 van de Mededingingswet*". (Informele zienswijze zaak 7285, Themadossier Food en agri, website NMA)

b. "Drie telercoöperaties en afzetorganisaties van paprika's hebben vanaf mei 2006 tot februari 2009 een prijskartel gevormd. Zij krijgen totaal EUR 14 miljoen aan boetes opgelegd. Via het kartel trachtten de ondernemingen de inkoopprijs van paprika's voor afnemers hoog te houden. Daarnaast spraken zij af om minimumprijzen te hanteren, om elkaars klanten te 'respecteren' en om de paprikaprijzen op de groenteveiling van ZON te manipuleren". (bron: tuinbouwcommunicatie)

c. "De NMA heeft een claim uitgedeeld van 20 miljoen aan twee paprikaverenigingen, en aan vijf telers van zilveruitjes, die hadeen een afspraak gemaakt over hoeveel ha. ze maximaal in zouden zaaien. Volgens mij hebben die zilveruitjesboeren een jaaromzet van 15 miljoen, en die krijgen een boete van 9 miljoen. Dat ken niet. Het is lastig klanten moeten bedienen zonder afspraken. Het is heel krom, want niemand is er bij gebaat als telers teveel produceren en failliet gaan" (De Jong)

Figure 10 - Box: regulations on cartels.

When comparing the descriptions b. and c. on the effects of the regulations from the NMA, the views are clearly contradicting. While the NMA describes the creation of cartels as a danger to the variety and affordance of products, many actors in the horticulture sector evaluate the discussions on quantities and prices of products contra wise. The regulation forbidding these discussions would have the result that no social mechanisms can develop to solving overproduction problems as well as prices that are under the cost price. Growers are not allowed to define shares strategies to solve these problems, as the NMA oversees that it is the market mechanism only working to solve this issue. This means for growers individually that if they face an issue in the market, they cannot discuss solutions on production quantities and product prices, but are dependent on the way the market mechanism works.

5.2.5 LTO Glaskracht

The purpose of LTO Noord Glaskracht is to represent the interests of the entrepreneurs connected to horticulture, employing a lobby function for its members. The advocacy is set around themes as sales, employment and education, energy and CO2, land, water, plants, environmental emissions and innovation. The members of the organization determine which subjects on the agenda are addressed and which results LTO Glaskracht should aim at in its activities (website LTO glaskracht).

The organization of LTO Glaskracht represents the horticultural interests of its members (at national, provincial and regional levels) addressing the issues that are identified by its members as most pressing. Examples of past themes are new regulations on pesticides and taxes on gas use. The role of LTO is to take up these issues and lobby at the Dutch government, and sometimes more local, at provinces and municipalities to represent the wished of the horticulture organizations.

The subject of the lobby activities is determined by the members of TO Glaskracht, which comes down to the mass of the group. This means that the interest of unique or innovative growers may conflict with the

general interest. This has implications on the effects on the lobby on innovation. The lobby is directed at changing existing institutions, but often also against renewal of regulations becoming more stringent, thereby playing a role in both the maintenance and change of institutions. As the respondent from LTO Glaskracht explains, the majority is in general not innovative, a small group is. This means that the lobby practices, determined by *the majority* of the members, does naturally not steer towards innovation:

"Nee, we hebben innovatie niet als doel, er is niets als doel. Als telers willen innoveren, iets wat echt goed en nieuw is, dan gaan we kijken of we daar subsidies voor kunnen binnenhalen. Alles kan, als het maar vanuit die grote groep komt. Er is nu geen behoefte aan, bijvoorbeeld marketing, door die grote groep. Het is een vereniging, dus we zijn wat dat betreft heeft iedereen een stem" (interview respondent from LTO glaskracht).

A reason that the majority does not plea for adapting regulations in favor of innovative practices, is that the regulations thereby become less beneficial for conventional organizations and practices. In times of crisis, this may be the case even stronger: *"Ook bij bedrijven kom ik volop ambities voor markt, innovatie en duurzaamheid tegen, maar in veel gevallen moet men de korte termijn problemen nu eerst het hoofd bieden".*

SIGN, the Dutch Greenhouse Foundation for Innovation, part LTO Glaskracht Netherlands and co-financed by the Productschap Tuinbouw (PT), works with Innovation Network to strategic innovations and to improve the environment in which entrepreneurs innovate. In *Opweg naar marktgericht innoveren* SIGN inspires with 8 innovative business cases, contributing to the product and market innovation of the sector. The efforts of SIGN are interesting for those that want to innovate, suggesting interesting business models. The contribution of SIGN is very useful in the sense that it develops new concepts, but the lobby practices of LTO Glaskracht are not affected by it: "*De lobby ligt echt bij LTO glaskracht, bij de grote groep, SIGN is echt bezig met concept ontwikkeling en kijken hoe telers een ander model kunnen vinden*".

This means that although innovative growers may be inspired and supported via SIGN, the lobbying activities still support the more conventional message of the group, not stimulating the government to change its formal institutions towards a setting in which innovation is encouraged.

Effects on growers

LTO Glaskracht is an organization that stands up for growers and employs lobbying activities in their favor. This means in practice that the lobby is in favor larger group of growers that are in general the larger companies, successful in cost price competition. The lobby of LTO Glaskracht may thereby disregard the wishes of growers that are different from the mass, like in the case of innovative growers, stimulating thereby trend of the mass. LTO Glaskracht does facilitate activities that encourage innovations like marketing innovation, to encourage growers, but as its existence is based on the wish of the majority, it stops there – until the moment the majority asks for it specifically.

Overall, the impact of the lobbying activities may sometimes speed up institutional change, when a larger group of growers demand for it, but in many cases, the lobby will be conservative by nature, protecting the space growers can move in when the risk of stricter regulations presents itself. The protection of conventional formal institutions and the presence of an organization representing (the majority) of its members, means that the institutional context is better suit for more conventional organizations – which are large process-aimed greenhouse companies. On the contrary, standing out and differencing from other organizations, may bring more difficulties as activities may clash with the formal institutions, and the lobbying activities are not likely to address those specific issues tied to the diverging strategies: being conventional can be said to pay off in this respect.

5.2.6 Merchandisers

Since the auction system for vegetables was dissolved in the nineties, the sector structure has changed significantly. The auction hall functioned as the link between production and merchandisers, selling products with the typical auction clock. The needle of the clock went from a high to a low price, tempting the merchandisers to hit the 'buy' button soon enough to be the first, but not too soon, as the price would be too high. Currently, the market structure enables merchandisers to collect price information from different sales cooperations or directly from growers, after which they can choose the cheapest option. Often, they sell their products to the supermarket or even another sales organization, who in their return also choose to buy from the cheapest merchandiser. As the products are perishable, the sales are time-bound, which puts pressure on the sales. This makes it easier for merchandisers to trade off grower(cooperations) against each other, just as they themselves might be traded off against their competitors.

The merchandisers have the aim to buy products for the lowest price possible, raising the suspicion and aversion of growers who aim to get a fair price for their crops. The strict separation between producers and merchandisers under the auction hall system still has major influences on the horticulture sector, as the mutual suspicion often still endures amongst growers.

Simply stated, both actors aim to make as much profit as possible. The merchandisers do so by buying from the cheapest grower, then selling the products for a higher price – as high as possible. Growers make a profit by creating margins on their products. Yet, they also have to deal with the strategy of the merchandisers who intend to buy the cheapest available products. This has the effect that growers (at least in bulk products) are forced to drop their prices in the competitions with peers, and have to realize margins by reducing the costs of their production.

Effect on growers

The core goal of expressed by the growers - is to produce crops and sell them with profit, safeguarding the existence of the organization and making an income to live from. When merchandisers have the ability to choose their products from many producers or sales cooperations , the merchandisers are likely to apply the strategy to buy from the cheapest. This means that growers that sell their products for prices that are higher than those from peers, are likely to get 'punished' as the merchandisers will go to a competitor to buy the same products for a lower price.

This means that by being in the position of producer, acting in a market in which merchandisers have to power to choose, the 'rule' of the merchandiser, which could be formulated as 'sell your crops at or below the market price of the product at that moment', dominates. When a grower offers his products for a higher price, he may not sell his products. The fact that the merchandisers have the power to formulate these rules, has to do with the market structure of several large merchandisers and the large group of still quite unorganized producers.

There are differences between bulk products and products directly sold to consumers and niche products, as the latter two are less interchangeable and are able to add value to products and market them in such a way that merchandisers are willing to pay a higher price. The power of the strategy of the merchandisers therefore has a larger influence on growers acting in bulk products and drawing upon the cost-leadership strategy, as in this competition, the price is the central variable.

5.3 Informal institutions

"*It is always the case that the day-to-day activity of social actors draws upon and reproduces structural features of wider societal systems*" (Giddens, 1984: 24).

The region of the Westland has a long history of horticulture and has been a region with its own culture and developments. The horticulture sector coincides with a community and a culture that is tightly intertwined with the sector, which makes the horticulture cluster – although increasingly industrialized - still an interesting case to research from a social perspective.

This section contributes to the understanding of innovation, as innovations and social change in networks and communities differ (F. Dal Fiore, 2007). Dal Fiore states that communities have a tension towards homogenization/conservation, drawing upon a space of belonging, while networks have a tension towards differentiation in a space of comparing, influencing the process of social innovation (Dal Fiore, 2007: 857). While the cluster in the Westland is neither fully a community, nor purely an industrial network, Dal Fiore's argument does raise the question what effect the community-embedding of the sector has. In order to explore this matter further, questions will be posted on how the decision making of growers is influenced by social institutions embedded in the shared culture.

The purpose of this section is not to give an in-depth overview or analysis of the culture in the region of the Westland among horticulture growers, but to gain insights in which social institutions are indicated as being dominant factors in decision making for innovations. These can be shared strategies of action, norms and shared logics. The institutions discussed follow from in-depth interviews with growers, their family members and experts.

5.3.1 Grower community

As addressed before, the horticulture sector has the special character of sharing a century-old history and culture, due to its relative isolated location for a long time (Ridder, 1979). Sharing a culture may imply that the members share symbolic vehicles of meaning and beliefs, practices and rituals. More specified to this research, a shared logic and shared believes in the sector may influence the way growers shape their organizations and make decisions. Moreover, strategies of action may be constructed from the shared "tool kit" of habits, skills, styles (Swindler, 1986). In this section, I will discusses some strategies of action, norms and believes that were named in the interviewed as shared social entities, and may be seen as a shared culture amongst the growers in the Westland.

Understanding the culture of the growers may give insights in those social institutions that – although informal – may influence the actions of growers considerably. The power of social institutions as norms and values originates from the risk of punishment by others when violated. Others may get upset or angry and may punish the violator by ignoring or shaming the individual. Other institutions have power in a more unconscious way. Shared routines and logical reasoning may determine decisions and practices in a more reflexive way. Some examples named in interviews with the growers are illustrated in the next paragraphs.

Physical work

An example of shared logic can be found in the expression: "*Niet lullen maar poetsen*" (Not talking, but doing it). This often-heard saying illustrates the hard physical work that many growers (mostly the older generation) still value. Some decades ago, the strategy of working long days in the greenhouse with mainly family members was a successful way to run a horticulture business. The products were shipped to the auction hall, and the grower would receive his money afterwards. Talking, negotiating and marketing weren't needed in this system. Nowadays, this saying seems to illustrate the issue in the sector: 'not talking, but getting down to work', as the current business model seems to require a bit more talking and less actual work in the greenhouse. After all,

many growers have to take care of their own selling and marketing after the auction system was dissolved, demanding a change in their mindset, activities and focus.

'Being cheaper than your neighbor'

Another phrase that is often heard is: "*Als ik zorg dat ik goedkoper ben dan de buurman, heb ik langer bestaansrecht*", illustrating the logic used by many in the fierce competition on cost-price. The competition is so stringent in the sector, that surviving seems to be the main strategy. The competition seems to be dominated by controlling the cost price, and not making mistakes. The reason for this is that the cost price of organizations are so close to each other, and so far stripped, that small mistakes can be fatal: "*En het is zo dat een dubbeltje besparen kost veel moeite, en een euro verliezen met een stukje minder optimale teelt, is zo voor elkaar*".

The strategy of being cheaper than the neighbor has of course very practical reasons, as not being able to control the cost price is a common reason for companies to go bankrupt in the Westland. However, some growers dare to move away from this conventional strategy, and show that other strategies are indeed possible. A very innovative grower - who has built up his own ties with English supermarkets - explained that setting up an organization in Spain opened his eyes, as he had to re-evaluate all the strategies, routines and ideas he took for granted in the Westland:

"*Een mens doet het grootste gedeelte onbewust in zijn leven. Hier in Nederland ging het al best goed, in het bedrijf en in het doen en laten. Dan kom je in Spanje; natuur is anders, cultuur is anders, en omdat deze omstandigheden zijn zo anders, gaan er zoveel dingen fout omdat je onbewust beslist over dingen. Hier kan dat; je kent de situatie. Het heeft me er wel in geholpen bewuster te leven en na te denken; wat doe ik nou eigenlijk allemaal, en wat onbewust? Dat proces heeft mij echt geholpen"* (Jos Looije).

This grower also chose to work with a specific type of tomato after he was stunned by its taste, accepting 25% less yield per square meter. This is a very unorthodox decision, as the yield per square meter '*Kilo de meter*' is a common measurement for success amongst growers.

"*Je hoort ook vaak van de teler wel waar hij mee zit, of waar hij mee bezig is. De een zit alleen te vertellen over zoveel kilo de meter, mij zegt dat niet zoveel (wel wat, want ik weet wat de normen zijn) maar ik vind het niet zo interessant*" (Respondent from the Rabobank).

The yield per square meter is thus used as a measurement of how successful an organization is. The more efficient, the more yield per m2, the lower the cost price is, and the better the position is in the market. However, when the yields of all growers increase, an overproduction occurs in the market, which drops the prices the growers get for their crops or flowers. It seems however that the strategies are so dominant, that these become legitimate strategies on themselves, reluctant of the desirability of the outcome.

Scale enlargement

Another business strategy that seems to be deeply rooted in social life and customs in the Westland sector, is scale enlargement. Below, six shared strategies and habits are described, showing how scale enlargement as an investment type is embedded in reasoning shared by many (not all):

1. Scale enlargement as the norm:

"*Vroeger lachtenze je uit met een klein bedrijf, maar nu is het anders, nu vallen ook de grote bedrijven om als ze geen hand boven het hoofd krijgen van de bank. Men gaat er ook anders naar gaan kijken, men laat elkaar in hun waarde. Dat was tussen de 20 en 10 jaar geleden, dat er neergekeken werd op kleine bedrijven. Toen werd en aangebouwd en schaalvergroot en geld verdiend bij het leven. Ja, je mot mee, geld ligt voor het oprapen".*

2. Scale enlargement as a logical strategy when a greenhouse of the neighbor becomes available:

"*De buurman is maar een keer te koop. Als hij te koop is, dan is dat je enige kans. Dus dan doe je dat gewoon"*

3. Buying a new greenhouse or expanding an existing one when a new son enters the business:

"Mijn vaders filosofie was toen nog; iedereen heeft zijn eigen bedrijf (dus niet alleen een taak, maar echt een bedrijf). Die heeft toen wel het idee gehad, we zetten het met zn allen op, maar iedereen kan wel zijn eigen ding doen. (…) Toen heeft hij toch, ook omdat mijn broer dat ook wilden, voor hun een eigen bedrijfje gemaakt, een eigen schuur en kas. Iedereen had zijn eigen verantwoording en bedrijf".

4. Scale enlargement as a strategy to bring down tax payments:

"*Als je niet investeert, blijf je belasting betalen. In slechte jaren kun je dan failliet gaan van het belasting betalen. Je leert zoiets vanzelf, je praat er met je boekhouder over, maar ook met collega's*".

5. Scale enlargement as a logical new step or way to keep it fun:

"*We willen altijd meer. Sinds ik tuinder ben (26 jaar lang), ben ik gewend te investeren (behalve laatste 3-4 jaar). Het investeren maakt het ondernemen leuk. Je hebt altijd verandering, en als je niet kan investeren zou ik het saai vinden*".

6. Scale enlargement as a believe on the right way forward:

"*Dezelfde schaal aanhouden is uitvoerbaar, maar je tekent je doodvonnis, je schaal hetzelfde houden is achteruitgang, het hangst samen met met economische achteruitgang dan*".

Scale enlargement seems to be embedded in several socio-cultural institutions in the Westland. The last quote shows how deeply the idea of scale enlargement is actually embedded in the socio-cultural institutions , as the way many growers innovate is based on a believe that there is no other way to go forward than growing in size, and controlling the cost price. This way of reasoning can also be seen in the way success has been (and often still is) expressed in "making x Kg per m2", "having reduced the costs to x € per Kg", "expanding with x hectares", earning "x € per m2". When these measurements of success are shared by a group, this may have a significant influence on how growers evaluate themselves and others on how successful they are. In other words, the shared norm on what should be considered as success may have a large impact on individuals, as pride or shame are based on the acknowledgement of others on one's success.

Education on horticulture

The former section explains how innovation decisions may be influenced by social institutions that are both norms as shared strategies and reasoning. Some growers do innovate in news ways, deviating from the conventional strategies, although this group is relative small: "*We hebben in de Nederlandse tuinbouw een kopgroep en een heel groot peleton, de groep die voor de bezemwagen zit. Als je het over sociale innovatie hebt, heb je het over de kopgroep"* (Interview with Hans Ligtenberg). The profession of managing a greenhouse moved from being a grower to being an entrepreneur. Many growers have difficulties making a switch: "*het is een heel andere manier van denken. Dan zie je dat de ene teler sneller ondernemer is geworden en sneller heeft kunnen schakelen dan de ander*" (Interview with Hans Ligtenberg).

Several respondents stressed that they believed change will primarily come from the new generations, which grew up in the current sector. Horticulture related education programs at Hogeschool Inholland focus specifically at changing strategies and innovation, which sometimes conflicts with current practices:

"*Dat is soms een ernstige handicap dat ze thuis een bedrijf hebben: ze zitten vast aan de structuur van het bedrijf, en hoe het thuis is. Dat is hun wereld, en dan ziet hun wereld er op die manier uit. Dan is het onze taak om ze die andere kant te laten zien, en andere bedrijven, internationalisatie en duurzaamheid. En ook dat duurzaamheid meer is dan alleen een ander hoesje erom. Ook dat marketing meer is dan een foldertje en een website. Dat zijn toch de onderwerpen waar we nu op koersen*" (Interview with Hans Ligtenberg).

Again, this quote shows that the horticulture practices, and also the innovation practices are deeply embedded in social institutions as believes and routines. With a changing sector and market, these strategies may not always fit as well as they used to, but the enduring character of these social institutions that are even transferred to the next generation, may persist.

Informal institutions and individuals

Growers in the Westland are in general very innovative entrepreneurs, continuously adapting, innovating and increasing the size of their businesses. It seems that the growers draw upon a shared culture, providing them with a set of norms, strategies, reasoning and 'toolkit of actions'. The idea of expanding their business is illustrated for example when a son enters the company, when buying a new greenhouse may be a more logical step then investing in a marketing plan. The same applies when a greenhouse of a neighbor is for sale.

Furthermore, certain values may affect the decision making of the grower. As yields per square meter are an important measurement of success, this value may affect the decision between investing in efficiency measures vs. product or marketing innovation. Similarly, the norm of working long days in the greenhouse may affect the choice to focus on internal process optimization versus marketing activities outside the greenhouse site. Growers can draw from this 'cultural toolkit' and use it in their horticulture organization. Examples of strategies, norms and believes are:

- Strategies: "When a neighboring plot becomes available, I buy it as it may be the only opportunity"
- Norms: "When a son enters the organization, a new greenhouse should be built for him"
- Believes "To be successful, a grower should produce as many Kg per meter as possible"

The presence of these social institutions shared by many members of the horticulture community may explain why adopting radical new innovations is not an easy job, due to the embedding of horticulture practices and innovation strategies in certain strategies, norms and believes. The horticulture sector and its community share a special culture, as the social institutions as just illustrated cut across business strategies, personal believes and family life. Stated differently; the social institutions are both embedded in a shared culture as in organizational strategies - thereby dissolving barriers between the agro-industrial activities and private family life.

This perspective on the horticulture organization and the growers steering it, may help to explain the slow developments in value-increasing innovations. Currently, marketing is a hot topic in the sector, and is promoted as a promising alternative innovation direction by innovation platforms and municipalities. Conferences, workshops, and other events are organized to promote marketing activities amongst growers. Many growers seem to recognize the importance and join the activities – as the meetings are visited by many. However, only in a small number of organizations significant marketing strategies are developed. The embedding of horticulture activities in the social institutions growers have incorporated may make radical developments for many growers too big of a step.

In the next paragraph, I will discuss the community setting in the horticulture sector a bit more, addressing the influence the special network ties in the sector may have on individual growers.

5.3.2 Network ties

"*We zijn eigenlijk meer collega's dan concurrenten. In ons wereldje zien we ons niet echt als concurrenten. We zijn eigenlijk veels te open*" (interview with grower).

The relationships in the horticulture sector are ambivalent and form an interesting and important aspect of understanding the horticulture system. Growers see each other often as colleagues as well as competitors, cooperating and helping each other, while also fiercely competing to survive. This raises questions on how this ambiguity affects cooperations, on how information is shared, joined initiatives are taken, and how innovation

spreads in the networks. The growers are tightly connected through different networks, such as through family ties, local proximity, cooperative organization, sub-groups in the cooperation, study groups on topics, etc. The relevance of understanding these ties is that the amount and type of information shared differs amongst the types of ties. Furthermore, innovation practices can be a joined action, wherein the decision making lies on group level.

Moreover, social institutions that are shared by a group may differ within the relationships. In smaller groups, norms can be imposed without external intervention, while on larger scale more organization is needed (Elster, 2007). Within families, norms may be naturally shared and taken for granted, while in grower cooperation, the norms of the group may have to be discussed and controlled with sanctions. This latter is sometimes necessary, because due to the close cooperation of growers, the misbehavior of one grower may affect the others. This can have the effect that regulative institutions may spill over into a norm against that behavior (Elster, 2007, 369). An example is the quality control and use of pesticides in the greenhouses. As the growers of cooperations like Prominent are often selling their products under one label, lower quality or increased traces of pesticides may spoil the image for all. In regular meetings, these very topics are discussed, sometimes rating the growers on their performance. What happens is that regulative institutions spill over to norms on behavior and results, being socially controlled by the group. The stronger the cooperation between growers, the more dependent they are on each other's products, increasing the mechanism of social control on fellow-growers.

Another example of social control was given at a mini-congress at Tomato world, where one of the participators of the focus group discussions stated: '*Sustainability should become normal. There was a grower that would still burn wood at his company, and he was frowned at by other growers, because it was not normal and conform current practices anymore'*. It seems that peer pressure from other growers can form important stimuli for individuals to change, like adopting more sustainable practices. An underlying driver for such social control is the fierce competition and the wish for a level playing field. The example in the section of municipal institutions showed how growers would visit neighboring municipalities to promote equally strict regulations for the greenhouses in that municipality. This example illustrates how the regulations spill over into the informal part of the system, becoming subject of social control.

The sharing of strong relationships, norms and information is special to the sector of the Westland and deserves further analysis. Writings on 'social capital' explain how social networks carry value, as collective and sometimes even economic benefits can be derived from preferential treatment and cooperation between individuals and groups. This is clearly the case in the Westland, as growers cooperate with each other quite deliberately, despite the fact that they are also competitors. The explanation may lie in social capital of the network.

The famous sociologist Pierre Bourdieu distinguished between three forms of capital: economic, cultural and social capital (Bourdieu, 1986). He defined social capital as "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition" (Bourdieu, 1986). He explains how actors in a close network can draw upon these relations for resources as knowledge, help, money, and etcetera. In his writings, Bourdieu explains how different classes may reproduce themselves over generations, by transferring social capital to their children, containing relations in a network, values, preferences and norms. Classes and those people belonging to classes have the same social capital they all recognize, providing them as insiders of such a close network with benefits tied to having the relations.

When using the frame of social capital to examine the horticulture sector, it becomes clear that a lot of social capital is transferred in the form of relationships, knowledge, background, norms, strategies, or even family names. In the interviews, the respondents made strong distinctions between those with a horticulture background from the Westland, and outsiders that do not have this background. Signs of belonging to the

insiders group can lie in nuances such as accent, jokes, and ways of communicating. An example of the barriers social capital can give for cooperation between insiders and outsiders, comes from a growers wife, who explains how they had experienced difficulties with outsiders in understanding each other and cooperating, whereby she suggested the 'other' to watch a very popular local band "Kromme Jongens" to grasp how things are done around the Westland: "*Het is wel moeilijker met iemand te communiceren die niet uit het Westland komt. We zeiden; kijk eerst maar eens de kromme jongens, dan praten we daarna wel weer verder. We begrepen elkaar gewoon niet*".

Coleman also stresses the effect social capital has on the way social networks are structured, defining it as a variety of entities with two elements in common: they all consist of some aspect of social structure, and they facilitate certain actions of actors within that structure (Coleman, 1988). Shared concepts, norms, trust and relationships generated by networks facilitate collective cooperation, but may also benefit a subgroup and create separation in networks. It may therefore be useful to explain differences of actors with varying social capital. Moreover, development of personal social capital is by other academics described as an investment in personal capabilities or social relations with expected returns in the marketplace. This may in some cases be obtained by buying it, as obtaining knowledge or capabilities at school, or investing in conferences or network events.

When it comes to social innovation, actors may display new behavior and ideas contradicting common strategies and norms, or: social capital of that network. This means that innovative growers may find resistance by other members of the network, as they might lose the recognition of being insiders that actors sharing strongly shared social capital might have. In short, social innovation brings about some social risk, as actors diverge from recognized social capital in a network.

5.2.2 Levels of ties

In the interviews growers clarified more about different forms of cooperation with colleagues. Paul van Schie for example, explained that there are 'levels of closeness' or 'circles' relationships can belong to. He explained that he cooperates with his family members on daily basis, although they run different greenhouses. These relationships are closest, which means that all information is shared, discussions take place on all topics, which has a large influence on the decisions he makes. Though horticulture and the way greenhouses look develops rapidly, norms on what success is or on how organizations should be managed are often shared within the family and transferred to the next generation.

A larger group of close colleagues and friends form another level, with who Van Schie does discuss dilemmas, although not on daily basis. One level 'further' away are the study groups that cooperations often have. In these groups, growers visit each other's companies and discuss the cultivation process of the greenhouse, but do often not talk about other topics such as finances, profits and clients. Cooperations, often involving many other growers are the next level of relationships, with a lower frequency in meetings and more general discussions. These layers of relationships where also identified by other growers, but vary in type and quantity per grower.

Effect on growers

The extent to which growers are cooperating with other growers influences the decision space of individual growers. In the example of Prominent, joint investments and innovations are undertaken, that are discussed and decided on together. These joined innovation practices create possibilities for organizations to innovate, as more expensive or risky innovations can be chosen due to the sharing of costs and risks. An example of an innovation that could be adopted is the 'gesloten kas' (closed greenhouse), which is quite a drastic innovation.

However, the decision space within a cooperation is also influenced, as growers decide together what to invest in altogether, determining the focus for the whole group. As one innovation is jointly chosen, the

innovation practices within the cooperation become more uniform, as joined initiatives are taken and sometimes, but also because the central path between extreme ideas needs to be taken to get to a joined investment decision. These effects of close cooperation of networks and the effect it has on activities of individuals can be explained with the work of Dimaggio and Powell (1983) and Boons (1998):

Growers that closely cooperate seemed to share the same ideas on what a 'professional horticultural organization' looks like. As colleague growers would go after the same ideal and copy each other's best practices, the organizations become more resembling to each other. The closer companies collaborate, seeing each other more frequent and share more information, the probability grows that this process of 'isomorphism' takes place (Powell and Dimaggio, 1983). The shared norms on professionalism can be very influential to growers, as for an organization to function well, other organizations – both peers as organizations in the supply chain – should trust the organization.

The benefits of the close cooperations of growers are often assumed in literature and by actors themselves. Boons poses the interesting question how the networks that organizations are in may have negative effects on solving issues (Boons, 1998). This applies both for organizations that cooperate on horizontal level (as in cooperations) as well as vertically (supply chain). In order to solve solutions and bring about change, organizations need physical resources as well as social resources such as legitimacy (Boons, 1998). In the case of the horticulture sector, the horizontal dependencies are strongly present given the close cooperation between growers, while, they are also indirectly dependent through their competition. I will use examples to illustrate this:

- Most growers are closely connected in a cooperation. Their innovations are often coordinated through mechanisms, of which some are formally arranged (promotional networks), and in many cases it entails the sharing of information (monitoring) (Boons, 1991). Not only finances are needed to initiate joint initiatives, but also trust and legitimacy of other members. These dependencies of growers may also hamper change processes, in the case problems arise in gaining the resources.

- The second example shows how the cooperation can have a negative effect for individual growers. What often happens when a grower successfully employs an innovation, is that other growers try to copy the innovation, quickly minimizing the beneficial position of the innovator. This has become a barrier for some to invest a lot in an innovations, as other may copy it and benefit from it without investing themselves.

The same negative effect of a network holds for relationships in the vertical supply chain. Currently, the power lays primarily at the supermarkets and suppliers. The decision of adding value to a product (for example through CO2 compensation for that product) and selling it for 5 cents per kilogram more, would now be very risky for a grower, as many merchandisers would not accept the price increase and buy the same product for less at a competitor. Also, presenting crops in a different box or cart would need the cooperation in the supply chain and supermarkets, making the growers dependent on them. The important point to take from this, is for organizations to bring about change in the horticulture activities, they are reliant on both peers as vertical related organizations, for resources and cooperation.

Concluding, the decision making of growers cannot be seen separately from social institutions, as growers share a culture with specific norms, shared strategies, and 'action toolkit'. Moreover, as the network of growers often entail close cooperation in both formal and informal structures, the shared culture has a stronger effect. First, because in the close cooperation typical for the horticulture sector norms are more easily shared and social control can more easily be exerted. Second, as organizations work together quite frequent and intensive, the chance that growers start sharing information, strategies and norms is higher. The relations and cooperations growers are embedded in are important variables to the decision making and therefore also innovation practices of growers. In the next chapter I will explore how these social institutions, both formal and informal, play a role in the decision making of different growers through a number of case studies.

6 Action-formation mechanisms: decision making

6.1 Introduction

The institutions described in the previous section can have a powerful effect on individuals. The institutions affect decision making not merely by reducing the behavior space directly, but rather via the risk of punishment when decisions are made. Actions are then caused by their (anticipated) consequences, like using light emission shields in the greenhouse to avoid a fine (Coleman, 1986). Actions are therefore intentional behavior, caused by the desires and beliefs of agents (Elster, 2007). In this section I will primarily discuss actions of growers concerning innovation practices. These actions may be preceded by conscious decisions, but can also be made in a more unconscious manner (Elster, 2007). Actions that do not require conscious decisions can be led by routines, habits, norms and beliefs.

Decision-making followed by action has a central position in the bath-tub model of Coleman, as it explains human action on individual level. *Theory of action* and social mechanisms are used to gain understanding on how individuals come to action and how they make decisions. In this section, I will demonstrate five stories to explain how individuals deal with the institutions and make decisions based on that. To understand the dynamics of the system in the Westland horticulture sector, I will take a closer look at the nature of actions. Some types of actions are common in the sector and have a more automatic character, while others may be more divergent and consciously made.

From the fifteen interviewed growers, five stories are were chosed based on their diffrenes, which will be used as illustrations - covering both the more 'typical' and conventional greenhouse organizations, as well as innovative growers, showing unique personal stories. Moreover, the selection was also based on the topics that were addressed in the interviews, aiming to discuss the most important variables for decision making and innovation practices in the set up five examples. The selection shows some of the variety in the sector, but entail personal stories – as every grower has his or personal story. Therefore, I do not want to make claim that these five examples - that will be used in the next chapter to model five types of growers – cover the variation in the sector. What they do show is five different ways how greenhouse organizations, social institutions and personal factors may lead to the choice for certain organizational strategies and innovation practices.

The value of this section lies in understanding the personal motivations, experiences and choices. Even though the stories may come across as quite elaborate descriptions, they are still simplifications of motives and decision processes. The decision-making process of growers formed the central topic in the interviews. In the discussions, the respondents told about their lives, their ups and downs, the changes in their own lives, in that of their families and friends, in their organization and in the sector. Especially moments of change and innovations were discussed, as were the moments when no innovations were undertaken. The conversations resulted in descriptions of life histories, stories, anecdotes, deliberations on the intertwined developments of private lives and the horticulture businesses. As the interviews were of open character, the obtained data is rich and includes many aspects of the lives of the respondents, yet keeping their innovation practices and the preceding processes as the central theme. As the data on respondents is rich and very specific per respondent, the five stories show how personal preferences, institutions, relations and beliefs lead to decisions and innovation practices.

6.2 Examples of individual growers

The use of real stories portraying growers will help us to understand innovation practices from the perspective of the growers and give insight in how decisions are made at the interplay of the organization, the market, personal preferences, family life and cooperations. Moreover, the case studies show a variation of growers that have made different choices in their lives and organizations and each try to run a horticulture organization in their own way. Some characteristics showing main differences of their strategies can be seen in Table 8. Fictive names are used and details may be changed to ensure the privacy of the growers; the names of Jos Looije and Scheffers are real names.

Case-studies:	Scale:	Consumer contact:	Bulk/niche	Official cooperation:
Eric de Jong	Medium	no	bulk	Cooperation
Ruud de Vries	large	no	bulk	Cooperation
Jos Looije	large	yes	Bulk size, niche market	none
Fam. De Boer	small	no	niche	Greenery
Fam. Scheffers	small	yes	niche	none

Table 8 - Grower examples having different characteristics

This section on decision making illuminated how growers make decisions, thereby showing how they balance personal values, formal regulations, social norms and their relationships. I discuss how the individual grower decides, reacts upon the institutions discussed in chapter four, and proceeds to the act of innovation. These mechanisms are of 'type 2' and explain individual action, by lining individual values to orientations to economic behavior (Coleman, 1996).

6.2.1 Eric de Jong

"Ik denk altijd: de kosten gaan voor de baten uit, en als je baten niet in kan schatten... Ik beredeneer vanuit mijn kostprijs. De marges zijn minimaal. Bij grotere marge, zou ik inderdaad eerder geneigd zijn iets aan marketing te doen, maar dat is logisch, dat geldt ook voor het budget van een gezin, dan neem je geen bloemetje meer mee. Een gezin is eigenlijk hetzelfde als een bedrijf. Je hebt kosten en inkomsten".

De Jong runs a horticulture organization of around 14 hectares. He started in the eighties after completing the Tuinbouwschool, with a specialization in cultivation. He succeeded his father who in return succeeded his father. His organization has grown quite a bit in the past years, after buying land when it became available, piece after piece. The example of Eric De Jong is illustrative for a large group of growers, portraying the dominant use of cost-leadership strategies. Moreover, his story illustrates the informal social barriers growers may run into when considering value-increasing strategies.

Investing

De Jong explains that the act of investing is a core element of running a horticulture organization; without investments it would be boring. He is used to invest already for 26 years, with the exception of the past years, due to the crisis. The motivation, but also the potential obstacle for investments is the effect it has on the cost price. De Jong is continuously looking for investments that can bring down the cost price of his products: *"De kostprijs is heel vaak de rem. We willen altijd meer. Sinds ik tuinder ben (26 jaar lang), ben ik gewend te investeren, behalve laatste 3-4 jaar dan . Het investeren maakt het ondernemen leuk. Je hebt altijd verandering, en als je niet kan investeren zou ik het saai vinden. Ik hoef geen rekenmachine te kopen, want als je even logisch nadenkt, even op de bank zit ('s avonds), brainstormt over hoeveel het kost, dan kom je er wel uit".*

A special reason Eric identifies to invest, are the fiscal benefits. As he can re-invest his profits in new technologies, he can minimize the amount of tax he has to pay while possibly improving his cost price: *"Een ondernemer heeft een hekel aan belasting betalen. Als je continu (gefaseerd) blijft investeren, dan heb je continu kun je van alle fiscale regelingen gebruik maken. Met de centen die je verdient kun je ook doorinvesteren, en betaal je heel weinig belasting. De ondernemer die dat kan, die doet dat ook. Investeringskosten mag je van de winst aftrekken, dan betaal je geen belasting. Als je niet investeert, blijf je belasting betalen. Je leert zoiets vanzelf, je praat er met je boekhouder over, maar ook met collega's".*

De Jong's reasoning is strongly focused on cost reduction, evaluating innovations thereby on the way they effect the cost reduction. His quote illustrates that it is not only about a good return on investment, but that cost reductions can also be achieved through smart investments achieving tax reductions.

Marketing

"Ik denk altijd: de kosten gaan voor de baten uit, en als je baten niet in kan schatten... Ik beredeneer vanuit mijn kostprijs. De marges zijn minimaal. Bij grotere marge, zou ik inderdaad eerder geneigd zijn iets aan marketing te doen." In this quote two things can be learned from De Jong's strategy that is shared by many growers in the Westland. First, the issue of marketing is that it is harder to calculate the potential benefits of an investment, compared to a machine that replaces labor, increase energy efficiency, etc. Second, this is a problem, as the competitive position of an organization can rise or fall with a difference of a couple of cents per Kilogram, which makes an investment in marketing without the certainty it will increase the sales or value is a risky action for De Jong. Furthermore, it does not match the cost-reducing strategy he is used to.

Also, many growers are struggling with the issue that their crops are bulk products that are not being sold under a clearly visible brand. It is therefore hard to see whether marketing efforts will result in benefits for his specific products: "*Bij marketing weet je niet of investeringen ook echt rendement opleveren. Onze cooperatie is niet echt een merk. Bekend bij de handel, maar niet bij de eindconsument. Bij marketing in de tomaat, kun je investeren als het goed is afgeschermd. Maar wij zijn zo uitwisselbaar, dat merk ik in de verkoop: Je kunt nog zo'n fantastisch product hebben, maar ben je 2 tot 3 cent per kilo te duur, dan kopen ze toch bij de ander".*

Nevertheless, the cooperation De Jong is member of does invest in marketing. De Jong has to contribute to these activities, as they sell their products to Fresq as a cooperation. In his case, innovations often start at the cooperation, where he may benefit from successful innovations and ideas of more innovation oriented growers. The membership to a cooperation is valuable, and can be identified as social capital, providing De Jong, just like the other members with benefits. The memberships to cooperations are formal, and the benefits are often easily identified, as shared information, help, discounts, the ability to copy successful innovations, etcetera. The example of De Jong shows how a quite conservative member becomes involved in marketing innovation, through this cooperation.

Scale enlargement

"Ik ben 14 keer zo groot geworden, en begonnen toen ik 18 was, en nu in de veertig. Als ik 25 jaarverder ben, dan zou het zomaar kennen dat je 200 ha bent". De Jong's organization has grown with a factor 14 in the past 25 years. In his life history story, De Jong explained how this steep increase was realized. His reasons turned out to be very similar to other growers. When he was born, the greenhouse of his father - and before that, his grandfather - was 0,9 hectare. The first greenhouse was added when he started working in the company when he was 18, the second addition coincided with his brother's entry. The moments of scale-enlargement didn't only coincide with the entrance of a son in the organization, but also when a neighbor went bankrupt; one of his greenhouses is settled on a piece of land of 12 ha that once used to have 10 different owners. The decision to purchase neighboring greenhouses seems to be supported by a shares strategy and logic, of a buying a neighboring greenhouse when the opportunity presents itself, as is a unique chance. Moreover, the investments could be subtracted from tax payments, not losing money to taxes, but rather re-investing it. This cost-reducing strategy is shared by many growers.

Not all organizations follow this path of growth. Some other growers explained that scale-enlargement of a greenhouse should best be realized by moving to another location in an existing bigger greenhouse, or to build a new one, rather than building an additional greenhouse. De Jong also underlined that his decision to stay at the same location wasn't the best financial decision as the adding of many small greenhouses reduces efficiencies and demand for renovations, but he decided to stay on the location, so that his family wouldn't have to move:

"In 1997 zag je wel dat schaalvergroting wel aan de gang was. De buurman is maar een keer te koop. Als hij te koop is, dan is dat je enige kans. Dus dan doe je dat gewoon. Dat zag je in de buurt ook veel, ja. Ik heb er geen

spijt van, maar puur kijkend naar de cijfers, had je beter de laatste 30 jaar beter kunnen zeggen: ik bouw een bedrijf van 4-5 ha., ik zit er acht jaar op, verkoop het voor veel geld, en bouw dan een bedrijf op van 10 ha, en dan weer na acht jaar, verkoop ik het weer, en ga dan voor een bedrijf van 20 ha. Drie keer verkassen was financieel denk ik beter geweest, maar sociaal vond ik het moeilijk om dat te doen, dus we zijn hier gebleven. Dat is ook de reden dat ik ben gaan samenwerken met mijn compagnon, om toch te vergroten. Samenwerken met iemand die geen familie is, is toch anders, maar ik ken hem wel al vanaf mijn 6e/7e.

"Maar we probeerden het eerst hier, want we woonden hier met ze drieen op een rij: mijn vader, mijn broer en ik. Dan zou je alledrie moeten verhuizen. Als je verhuist dan moet er sociaal veel veranderen, dan staan de kinderen niet te juichen".

The quotes show that the decision to move or stay doesn't have to be solely a business decision. Since the families often live at the plot of the greenhouse, moving means also moving as a family, to a new area, new school, etc. By taking his family into account, De Jong did not per se choose for the financially maximizing solution, but for an option that would be acceptable for his family as well as his organization. This shows that actors are not maximizing their profits to the expense of everything, but that those decisions are made in a setting where family life matters just as well. In this case, the value to stay in the house they were living in overruled a financially optimizing strategy.

De Jong's organization is large, but not the size that he would not be able to take over tasks of his companions. He explains that he would like to keep it like that, as he enjoys walking around in the greenhouse in dirty cloths, rather than having to be the manager and get separated from the processes in the workplace: *"Wij zijn nog niet zo heel erg groot, en dan loop je er ergens tussen, en manage je het hele project. We zijn wel gespecialiseerd, maar ik kan overal instappen, ik kan alle taken zelf doen. Samen met mijn broer en compagnon. Iedereen kan elkaars taak overnemen. Bij een groter bedrijf, dan heb je een manager en assistent-manager nodig. Dan moet je elke taak ingevuld hebben, want de eigenaar heeft daar geen tijd meer voor. Dat ambieer ik niet, ik vind het leuk om ertussen te lopen, in vuile kleren".* Again, this quote shows that personal preferences are important in business decisions. In De Jong's situation, the decisions in the organizations are clearly the result of both personal preferences and ideals on the organization, as well as economic factors. Moreover, it shows that De Jong has followed the path of scale-enlargement quite far, but that he did not want to move of loose the connection to the daily processes in the organization.

Risk

When discussing the potential of innovations like the polydome greenhouse, the risk of a non-optimal horticulture was noted as the core barrier. The margins are so small in horticulture business that the cultivation and management have to be optimal to make money of the production. Innovations as the polydome carry more uncertainties in the eyes of De Jong, as multiple crops have to be managed. Problems in one of the brands would mean no profits overall. Specialization helps narrowing the risks to one crop, and make the crop better controllable: *"Ik denk dat het moeilijk is om alles goed te doen. Met ondernemen moet je het 100% goed doen, en als je vier richten doet als vier planten/bloemen/vissen/kippen hebt, en je doet 1 van de 4 niet goed, dan heb je gezamenlijk geen rendement. Dan zou ik liever specialiseren".*

The same holds for marketing: the risk of making investments that do not pay back is tricky, as the competition can be decided upon just 2 or 3 cents per kg. The tomatoes are bulk products, which makes him interchangeable. If his price is just a bit higher, the supermarkets may buy from a competitor: *"Bij marketing weet je niet of investeringen ook echt rendement opleveren. Wij zijn zo uitwisselbaar, dat merk ik in de verkoop: Je kunt nog zo'n fantastisch product hebben, maar ben je 2 tot 3 cent per kilo te duur, dan kopen ze toch bij de ander. Wat is dan marketing, en hoeveel moet je daar in investeren?".*

De Jong's decisions are based on the strategy to minimize risks in his organization by controlling his cost price by improving the internal process of his organization. This means that he is more likely to invest in innovations that are less risky or where the return on investment can be calculated. This strategy is based on the information De Jong uses: bulk products are always easily replaceable, which makes investments in marketing useless or risky. This believe is shared by many growers, which withholds them from investing in marketing. One could argue that the mechanism of self-fulfilling prophecy is at work here, as indeed – the crops are all identical and easily replaceable *because* there is a lack of marketing.

Uncertainty

The future of the organization depends on for how long his generation continues and whether the new generation wants to take over. If his partner decides to quit and wants to be sold out, it may have a large impact; the cost-price increases while no innovations or improvements are made. When the new generations want to get involved, they can be sold out by the new generation, otherwise, they have to buy each other out: *"Gaan ze met zijn drieeen samenwerken, of gaan de andere jongens zich ergens inkopen, of mij uitkopen. Ik kan wel twintig opties verzinnen. Zij moeten gaan nadenken welke richting ze op willen, en dan kunnen we naar de mogelijkheden kijken. Ik weet niet wat er gaat gebeuren. Ik wil wel een tijd door, maar het hangt er ook van af wat mijn zoon wil. Voor mij maakt het niet uit wat mijn zoon gaat doen, en de andere jongens, maar het is wel het boeiende om dat voor hen op de rit te zetten".* His quote shows growers have to anticipate on many things when making investment decisions, as potential future developments. Eric de Jong has to anticipate on the new generations, which add to the risk in his organization.

Besides the future of many organizations is uncertain, also the market issues add uncertainty. De Jong shows how unexpected developments in the market, as the EHEC crisis of the year before, may put his organization in a vulnerable spot financially: *"Vorig jaar hadden we die EHEC-crisis, maar dat jaar daarvoor was goed en kun je sparen en een plannetje uit gaan werken. Dus maak je een bedrijfsplan, vraag je een investering aan, enz. Alleen het andere jaar heb ik het weer in moeten leveren, dus dan ben je weer terug bij af. Je bekijkt het van jaar tot jaar".* Uncertainties have the influence that growers need to be a bit more precautious, as the co-occurrence of these risks may be dangerous for an organization's continuation. As the continuation of their organization often one of the first aims of growers, the strategy of minimizing risks is rational strategy for many.

6.2.2 Ruud de Vries

"Waar de barrieres zitten om meer met marketing bezig te zijn? We zijn heel erg met ons bedrijfje en product bezig. Ik ben zelf een halve tomaat, maar als ik hier wegrijd ben ik opeens weer gewoon een burger, die eigenlijk te weinig op straat komt. Want er gaat hier heel veel tijd verloren. Ik kom weinig buiten, ondanks dat ik voor die werkgroep van onze Cooperatie - de rassencommissie - regelmatig buiten kom, maar dan zit ik weer tussen allemaal collega's. Ik ga misschien wel eens naar Amstel Live, of op devoetbalvereniging, maar dan kom ik weer allemaal tussen collega's".

Marketing

Ruud believes in marketing, even in his segment of bulk products (tomatoes): *"Marketing? Ik denk dat daar de meeste winst te behalen valt. Als die tomaten meer gaan opleveren, omdat je ze goed kan verkopen, dan kun je veel meer winst maken. Dat zet zoden aan de dijk".* As explained in the introduction quote, Ruud sees the barrier for marketing in the 'inward focus of growers' in their networks embedded in the horticulture sector and internal to their organization. He is often working in his organization, and when he does leave his site, he often visits other greenhouses or is in the company of other growers. This narrows his contacts to those people in the same sector, sharing the same knowledge and insights. The barrier to invest in marketing innovations does not lie in the believe this is not profitable, as in the case of De Jong, but rather lies in his inability to do so. As Ruud explains, his obstacle seems to lie in the limited variation of his professional and social contacts, therefore missing the connections with other people who might have brought new ideas and skills.

According to Ruud, it has to do with the way of thinking and the language. He could cooperate very well with his grandfather, who also focused on 'good, cheap and fast' cultivation: they share the typical mindset that many growers have. He is always active in his organization, and has very little time to devote to marketing: *"Het gebeurt bijna niet dat ik hier de hele tijd kan blijven zitten, ik word altijd weggeroepen, want er is altijd wat aan de hand. Ik heb de arbeid te regelen ook een opa in dienst gehad, en dat was een kloon van mij (alleen ouder), dat ging geweldig. Hij heeft hetzelfde doel: Het moet goed, goedkoop, en snel. Dat zijn precies de steekwoorden die ik ook heb. Echt geweldig" .* The social capital that many growers share, as shares values, norms or ways of working and communicating make the cooperation between them very efficient and smooth. The shared norms and strategies form guidelines for growers to work with, and are often embedded in practices, cooperations and ways of doing things. An outsider or socially innovative grower might therefore have more difficulties cooperating with peers. The comfort this shared understanding brings might therefore form a barrier to start doing things radically different.

Ruud names examples of a growers that entered the horticulture business from another profession, and stresses the difference in language and approach: *"Sommige telers zijn geen tuinder, die hebben in andere functies of sectoren gewerkt, en rollen er in. Maar communicatie is veel leuker voor hen dan telen, zij hebben vaak ook helemaal geen verstand van telen. Die praten een heel andere taal".* According to Ruud, it is very hard to move into marketing for him, as he is embedded in his organization, way of thinking and network. Because marketing demands such a different focus, language, mindset and activities, he thinks the marketing innovations should come from 'outside', from non-growers, as he does not see himself capable to adapt to the different requirements that marketing development demand: "*Mijn werk is tomaten kweken, en dat is iets heel anders als marketing. KopperKres, dat is een wereldmarktleider in kiemgroenten, die doen het geweldig. Die man staat ook altijd in de krant en in boekjes, maar dat is geen tuinder, maar meer een marketingman. Dat is zijn ding. Hij is ook geen tuinder van huis uit. Of dat belangrijk is, dat zulke mensen erbij komen? Dat denk ik wel, want wijzelf kunnen dat denk ik niet".* This analysis touches upon a phenomenon by some described as 'sectorial blindness': the extended version of organizational blindness, caused by the close cooperation of resembling organizations. Due to the similarities and the same perspective of cooperating growers, the strategies and problem solving may be uniform amongst peers. Cooperation with organizations that are very

different or are even active in a different sector, may provide new insights and approaches; however, as explained by Eric, the community is strongly embedded in the region amongst grower families, which has led to local friends active in the same business.

Ruud is connected to a grower cooperation, Prominent, where different study groups focus on topics as purchases, cultivation, seedlings, sales, marketing and employment. This solves for him the issue that he doesn't have the time and capabilities for developing marketing strategies, as a special study group does this for the whole group. In the marketing group, interested growers and professionals are working on marketing strategies for the whole cooperation. The effect for Ruud is that he can focus on those topics that he is best qualified for, and can still benefit from the marketing group. The cooperation provides him with benefits that he wouldn't have himself, making cooperating an effecting strategy to extend innovation practices.

The next generation

Ruud explains that new generations can be the driver of change. His father was innovative in his time, making a system that could open the windows automatically. He did not scale it up though, as he did not see the need: *"Hij had een kas die met de hand open moest, en daar heeft hij een motortje op gemaakt, in '67 misschien. Dat was echt wel vooruitgang. Andere tuinders moesten ieder raam met een pen openen, hij kon een hele rij in 1 keer open doen. Hij dacht altijd wel groot. Hij ging wel eens naar een grote tuinder en vroeg: waarom ben jij nou groot? Ze hadden nooit een goed argument, en daarom ging hij niet vergroten."* The latter remark on scale enlargement points to a shared strategy that has obtained legitimacy on itself, regardless of its outcomes: scale-enlargement was a trend of rationalization and mechanization, presenting the norm for horticulture organizations.

Later on they did increase in scale as Ruud entered the organization and the greenhouse turned out too small for two. This way of scale enlargement is often seen amongst growers. He obtained experiences abroad and started with his ideals and fresh energy in the organization, modernizing the greenhouses: *"In 83/84 hebben we 8000 meter bijgekocht, en waterbassin gegraven, en 4000 meter bijgebouwd, dat was een hele moderne kas, 3,5 meter hoog (toen was dat heel hoog), toen hebben we een railsysteem aangelegd (dat karretje over de buizen rijden). Dat was vooruitgang. Je bent jong, in het buitenland geweest, een bepaald doel voor ogen, en daar werk je naar toe. Als 3,5 meter gangbaar is, dan bouw ik hem 3,5. Innovaties moeten wel economisch verantwoord zijn, maar sommige dingen kan je niet berekenen".* Ruud has a vision on what his organization had to look like, adopting the newest innovations. His personal preferences guided him in shaping the organization towards a modern greenhouse. Ruud shows in his quote the importance of the life stage the grower is in; as a young man, innovation and modernizing the greenhouse is suits his life stage, while in the example of Eric de Jong, the rounding of and transfer of the organization is a more important theme.

Environmental performance

In the years Ruud runs his organization, he has adopted many technological innovations, such as the CHP's, substrate cultivation, and a box folding machine. He adopted the CHP as he could sell the electricity and could use the heat for his greenhouse. The use of substrates was a result of the regulations and prohibition of methyl bromide, which made soil cultivation non-economic:

"En de substraten in de jaren 80, dat is ook een innovatie geweest. En dat is ook eigenlijk voortgekomen uit een probleem, want vroeger kon je de grond nog ontsmetten met methyl. Dat mocht niet meer op een gegeven moment. En stomen gaat niet: is te duur. Hoe kan je dan jaar in jaar uit tomaten telen in een kas? Dat kan niet. Toen zijn we op een ander soort grond gaan telen, met steenwol".

The innovations towards substrates were stimulated by regulations that made it difficult for growers to grow year-round, forcing them to look for other ways to solve the problem. Despite this pressure from outside, he is satisfied with the result it gave, as it became more sustainable – due to the cyclic streams of this system. It

seems that this sustainability aspect hasn't played an important role in the decision making, but is named as an important positive side effect after the adoption:

"De kwaliteit is beter geworden, en het is voor het milieu in principe beter geworden: water vangen we op en wordt weer gebruikt (bijna gesloten), dat gaat eigenlijk hartstikke goed. Dat hebben we alleen ook weer vergeten te communiceren met de consument, dat is een beetje dom. Wij staan heel dicht bij de teelt en staan ver van de consument af".

His analysis is important insight in an error in the sector. The increased efficiency and thereby sustainability of his greenhouse could be said to increase the value of his products, as they are produced in a more sustainable way. Nevertheless, the cost reductions in general *decrease* of market prices and their value. The combination of process optimizations with efforts translating this to a higher market value seems to be the solution here. Now, many growers are solely active in the process innovations, supported by cost reducing strategies.

Communication with consumers

Ruud stresses that in both the cases of the CHP and the substrate cultivation with closed water system and recycling, they were unable to communicate these improvements with the consumers. He adds that this may not change in his generation, but that he expects the change to come from the new generation, in his case perhaps from his son, who studies at TU Delft and already discusses issues with his father: *"Jij stelt vragen, waarom doe je dit waarom doe je dat, en dan denk ik: waarom doe ik dat eigenlijk. Die discussies heb ik vaak met mijn zoon tegenwoordig. Hij is in discussie denk ik iets slimmer dan ik. Dan zegt hij dit moet je anders doen, en dan zeg ik: ik heb het altijd zo gedaan. Maar als je altijd hetzelfde blijft ga je niet vooruit. Er gebeuren natuurlijk ook heel veel onderzoeken, ook op tomatengebied, die lees ik wel"* .

An example Ruud gives is the use of (social) media. He has seen it in other countries, as the US and Canada, where growers have beautiful websites to sell directly to buyers and consumers. Moreover, he likes media as twitter for solving problems, but states that he may be too old to this trend: "*Er zijn mensen die Twitteren zich helemaal scheel, maar het is wel een manier van communiceren die helemaal niks kost! Mooier kan je het niet doen. Ik hoor steeds meer mensen, als ze een probleem hebben: 'Ik twitter het wel even rond, en dan komt het wel goed' . Ik ben daar wat te oud voor denk ik, ik heb al een half uur werk als ik een SMS-je moet gaan tikken. Als ik zie hoe mijn kinderen daarmee bezig zijn, dan denk ik die dat veel beter zijn, dat ik een oude bok ben geworden. Ik vind het best wel lastig om dat te constateren".*

Hence, Ruud sees the future of his organization and marketing innovations lying in the hands of the next generation. The issue more growers are dealing with now, is that it is not as certain anymore that their sons take over the company. This is a problem, as the organizations are often worth millions of Euro's, which is hard to transfer to a new entering entrepreneur: *"Mijn zoon zit nog niet in het bedrijf. Hij is 18. Of hij in het bedrijf wil weet het niet. Hij gaat naar de TU. Het zou zomaar kunnen gebeuren, maar hij gaat nu niet echt een tuinbouwrichting volgen. Het is zijn keus, ik ga geen sturing geven. Dat het minder van vader op zoon wordt doorgegeven, is inderdaad wel een puntje van zorg voor ons. Wij hebben iets moois opgebouwd, maar ik ben nu op een bepaalde leeftijd, en ik blijf dit geen 20 jaar meer doen. Van de andere kant, als we willen stoppen, wie kan die toko nog kopen?"* Ruud explains that nobody can take a loan of 40 million euro's, which makes it hard to sell the organization. It makes a big difference whether he will transfer the organization to his son or someone else, or that he has to break down the greenhouses and sell the land. This makes it hard to make investments. Withdrawing from the horticulture business thereby keeping enough money for a pension is very hard these days, which often creates severe psychological pressure for growers.

Subsidies

As touched upon before, many growers have a very negative opinion about subsidies as the GMO subsidy – just like Ruud. Nevertheless, he did benefit from the subsidies, because it was available and welcome when making

large investments. He made the decision to make use of the GMO subsidy, as he has to if his competitors do benefit from it: *"Subsidies vind ik heel slecht. Ik zeg niet dat ik er niet aan meegedaan heb, als het er is ga ik het niet laten liggen. Die moeten ze allemaal afschaffen. Dat klinkt heel stom, want wij hebben er ook zat van gevangen, maar omdat het er is. Ja, je moet wel omdat anderen het doen. Ik denk dat er heel veel dingen niet gebeuren omdat er een claim van subsidie terugbetalen boven hangt. Er gaat best wel veel geld in om in die GMO".* From his standpoint, rejecting the subsidy is irrational, as he receives 'free money' for investments.

The presence of the subsidy had several impacts; the GMO subsidy became an important part of the competition between growers, due to its availability. An interesting insight that Ruud provided, was that there is only one innovation that he would not have bought without the subsidy. The innovation that would probably not have been adopted in the sector without the subsidy, is the pelletizer: *"Maar op het onderdeel van de pelletiseerder, dat daar subsidie op was, was een goede zaak, want anders was het niet uitgevonden. Zo'n ding was best duur. Als dat ding niet in de sector was ingevoerd met behulp van subsidies, was die misschien nooit gekomen. Maar voor de rest ben ik tegen subsidies".* The important insight from his quote is that for the vast majority of investments the subsidy was complimentary, but not determining for its purchase.

What the use of the subsidy did do, as Ruud notes, is holding back activities that are forbidden in the contracts tied to the subsidy, due to the fear growers have of having to pay the subsidy back. What can be understood from his explanations, is that the GMO subsidy is easily used by growers as it is easily obtained money, after having large 'side-effects' due to its regulations.

Regulations

Companies are growing and professionalizing, as is the sector. Ruud explains the differences between 20 years ago and now. In the eighties, it was still possible to use pesticides that were officially forbidden, but this would be out of the question now: *"Ik denk dat je 20 jaar geleden nog wel eens stiekem een bestrijding uitvoerde die je niet registreerde. Dat bestaat niet meer, dat zou ik niet durven doen, want ik weet zeker dat ik dan de lul ben. Dan is in de gaten gehouden worden toch nog ergens goed voor, want de consument moet een veilig product hebben. Vroeger was het maatschappelijk geaccepteerd, dat je wel eens wat deed wat niet mocht. Ik zou het niet doen. Als ik een middeltje in deze teelt niet mag gebruiken, ga ik het niet gebruiken, geen haar op mijn hoofd".*

It is interesting to see that not only the audits have developed and become stricter, but that the social acceptability has changed: where it used to be acceptable some decades ago, this is no longer the case. Regulations that used to be enforced by the municipality, now have spilled over into social institutions, becoming norms that are shared and managed with social control by peers. Another aspect of this, is that growers as those of Prominent are now selling their products together. This means that all growers would be affected if one grower gets caught using banned pesticides. The close cooperation and joined sale of crops thus brings about a setting in which social control plays an important role. As the growers are cooperating together closely, having each other over at their greenhouses, social control helps safeguarding the quality for all.

Loans from the Bank

Ruud explains that the bank has quite some control over the management of his organization, especially since he had invested in crisis time: *"De eisen die gesteld worden aan het management zijn best wel hoog. Misschien hebben wij het ook nog tegen dat wij met name de laatste jaren geïnvesteerd hebben en dat een bank ook van boven in zijn nek gehijgd wordt, en die hijgt dus door naar de klant – naar ons".*

More specifically, the bank aims to minimize the risks of the money it invested in horticulture organizations. Ruud has to deal with the issue of rising energy prices. These have increased quite a bit, and since the energy market liberalized, he is responsible for the buying and selling of energy. Since he uses CHP's, he buys natural gas and sales electricity. If he does so on different moments, he can make profits – or losses.

Some strategic buying and selling is needed to reduce energy prices, although he is not allowed to 'gamble' as this involves risk, which is not allowed by the bank: *"De toekomst is altijd onzeker, alleen het wordt elke dag erger. Vroeger had je wel eens dat je product heel veel opleverde. Dat gebeurt niet meer. Je hebt alleen de dalen, niet meer de pieken. Goedkoper wordt het niet meer, alleen maar duurder. Onze energiekosten zijn begin dit jaar 6,50 euro per vierkante meter, en volgend jaar is het 12 euro, dat is best veel. Het is zijn taak [energie expert] om te zorgen dat dat ook 6 euro wordt. Dat kan niet. De bank zegt: je mag geen risico nemen. Je kunt wel meer uitproberen met energie-inkoop, maar dat kan ook de andere kant uitlopen, dat heet gokken. Lopende het jaar kan hij nog 1,5 euro per meter wegpoetsen, als hij het goed doet".*

His quote shows the decreasing space to maneuver in, leading to the desperation of many growers: the margins on products decrease as the energy costs rise while the market prices fall. Speculation in energy prices might be a way out of the high energy costs, but is prohibited by the bank. It again shows the constrained situation many growers are in now.

Prominent – taking own control

Prominent is a special cooperation, as the members stepped out of the Greenery searching for a cooperation in which they could have control over their sales. Some growers explain that the Greenery continued the separation between growers and the market, as the organization controls the sales. Ruud decided to join prominent, as he believed to achieve more progress with other growers that take their own action: *"We zijn in 2009 bij Prominent gegaan. We hadden het idee dat daar mensen zaten die wakker waren, en dat je samen verder kan kijken".* This decision is not without risk, as they risk a fine of millions. These potential claims often withhold growers from taking decisions and breaking free from contracts. In the case of Prominent, the members have decided to take the risk together, as they do with innovations tied to their core-business: *"Wij zijn verleden jaar van de Greenery naar FreshQ gegaan, als het tegenzit hebben wij als Prominent een claim van 6,5 miljoen boven ons hoofd hangen. Dat is wel heel veel geld. Wij hebben wel gezegd dat gaan we gezamenlijk dragen. Als dit bedrijf zijnde was het 5,5 ton. Ik had dat niet gedragen, ik was dan bij Greenery gebleven. Dus er worden dingen niet gedaan omdat er dan een claim boven je hoofd hangt. Dat hoor je wel vaker, dat dat een nadeel is".*

Joining Prominent meant that Ruud would still run his own organization, but cooperates in a facilitating organization that could help him with the purchasing of materials, sales, energy issues and marketing. In the seven working groups (marketing, sales, and purchase of materials, energy, employment, and seedlings/crops). One of the aims is also to innovate, which means taking some risk. Sometimes one member takes the risk, sometimes they all do together, depending on the innovation and growers. They together own two greenhouses in which they aim to produce tomatoes year-round in a sustainable way. Applying CHP's and artificial lighting where innovative at the time of adoption, whereby the 23 members at that time shared the costs and risk, but could all benefit of the innovation and testing (source: interview with Arne van Aalst).

The cooperation can help individual growers to execute their innovations and experiment without too much risk, but the other effect of the shared innovations is that decisions are mediated within the group. As growers with different tomatoes, visions, company scales and market segments are cooperating, some decisions have to be discussed: *"Binnen Prominent krijg je dan verschillende bloedgroepen en belangen. Of het een barrière is voor samenwerking? Dat botst af en toe wel ja. Je moet gewoon samenwerken op de dingen die elkaar raken. Als je dat goed in kan schatten van tevoren is er niets aan de hand. Marketing of kleinschalige verkoop is bij anderen veel belangrijker dan bij ons. Wij verkopen volle auto's en zij verkopen pellets".*

Although Prominent was a step towards own control, Ruud explains that there are problems in the supply chain that brings down his space to maneuver. He explains that the sales working group has to struggle to get one or two cents more per kilogram, while tomatoes are sold for more than twice the price. The problem is that some parties in the supply chain earn a lot from their product, Ruud explains. He relates this to the problem that growers like him get stuck when their products move towards the merchants and consumers. He

has no knowledge on sales and marketing, which he identifies as an issue for growers to improve their position: *"De groothandelsprijs is 2 euro per kilo, en wij kregen 78 cent. Ik weet daar komt een pellet, transport etc. bij, maar dan is er iemand die knap meer verdient als ik, en weinig doet. Hij neemt misschien een stukje risico, maar voor de rest doet hij niets. Dus dat is best wel eens pijnlijk. Wij zijn heel erg gericht op ons bedrijf. Zo gauw het richting handel en consumenten gaat, lopen wij helemaal vast. Hebben we niet geleerd op school, geen verstand van. En dat is denk ik wel een mankement".* The structures and power relations of the current supply chain plus the still relative unorganized character of the production side of the sector, make it hard for the growers to regain more power.

Decisions

Ruud describes the past decades he has been active in his organization, and shows that through the years, he has grown quite a bit and has adopted also several innovations in an early stage. He shows that joining a cooperation, as Prominent, gives him the possibility to innovate on topics he doesn't know much about, as with innovation. The cooperation with his companion brings a special dynamic to the decision making, as they are quite different. He explains that he likes to take the chance and go for innovations, while his companion can slow it down when needed: *"Peter en ik zijn heel verschillend. Dat is heel lastig, maar ook heel makkelijk. Ik houd van gang en van gas, hij ook wel, maar ik loop altijd iets harder als hij".*

Stuck in specialized organization

Ruud explains that his organization is so far specialized and capital-intensive that it is out of the question to change the crop he is producing. The barrier does not lie in his employees per say, as they can be retrained, but the way his organization is set up for a specific crop: he is condemned to this crop, he cannot decide to change crops: *"Overstap naar ander product: Eigenlijk is dat geen doen. Ik ben ingericht voor tomaten. Ik ben gewoon veroordeeld, als je bedrijf af is, is dat geen beslissing meer. Dat is ook investering in bedrijf, ja. Als je paprika's gaat telen, dan moet ik alles aanpassen in de kas, alles wat hier staat ken ik weggooien, dan ben je gewoon 1,5-2 miljoen verder. De 5 vaste mensen die hier lopen zijn nog wel bij te spijkeren, en voor uitzendkrachten maakt het ook niet uit. Ombouwen bedrijf is bijna niet te doen".*

Personal preferences

The scale of Ruud's organization has grown quite a bit the past decades. He is starting to believe that this trend may continue, resulting in just a dozen large organizations ruling the sector. This could be nice if he would be one of them, but he also admits that he has to overcome some of the aspects he does not like so much, as having many employees in his organization: *"Of ik denk dat schaalvergroting ophoudt een keer? Ja. Er zijn mensen met 50 ha. Ze hebben op school wel gezegd: er zijn nog tien bedrijven over 30 jaar. Toen zei ik: jullie zijn gek. Nu denk ik: misschien hebben jullie wel gelijk. Het gaat wel hard. Wat ik daarvan vind? Het leukst is als je er zelf bij zit. Het kleine tuintje dat ik had was hartstikke leuk. Dit is anders leuk. Als teler moet je soms wel eens iets doen waar je niet achter staat. Of schaalvergroting daar bij hoort? Ik vind dit wel leuk, maar het heeft wel heel veel nadelen".* His quote shows that scale-enlargement is a trend that continues, sometimes demanding decisions of a grower he may not like.

Advisors

The information Ruud acquires comes for a large part from prominent. Besides, advisors on finances, technology and environmental taxes help him to make the right decisions. Sometimes, innovations originate from the bank: *"Bij Prominent zitten we, daar hoor en zie je best wel veel. Op teeltgebied heb ik twee adviseurs lopen, daar bespreek je teelt technische zaken mee (op beide bedrijven 1), over hoe de beste kwaliteit kan maken met minste milieubelasting, hoe je het rendement kan verhogen, daar komt het eigenlijk op neer. Van de bank komt ook wel eens een innovatie vandaan. En we hebben nog een financieel adviseur" .*

Taking a chance that presents itself

In Ruud's explanation, as with many other growers, investments occur as a result of a self-induced idea, while in many other cases 'the possibility presents intself': *"Dan moet je een lumineus idee hebben, of er komt een trein voorbij, nou en die kwam dus voorbij".* Both active decisions as reactive decisions take place, when, for example a colleague proposes a joined innovation.

Crisis

In times of crisis, Ruud keeps on investing, but does not take risky decisions: "*Ik kies iets meer voor zekerheid. Je gaat geen nieuwe dingen doen die gevaarlijk zijn. In moeilijke tijden ben je wel conservatiever denk ik. Of er ruimte voor is voor innovatie dan? Ja, ik denk het wel. Wij gaan ook door nu".* This means he may invest in exiting technologies, which he wouldn't categorize as innovating: *"Van de week is er nog een nieuwe machine afgeleverd, en er komt een dak op onderwaterbassins. Dat is misschien geen innovatie, meer een investering. Ik noem het een investering omdat het al jaren bestaat, en we het voor dezelfde toepassing gebruiken. Toevallig was er net die GMO van het jaar waar ik het al over heb gehad, die dat afdekte, toen was het helemaal gemakkelijk".* The availability of GMO subsidies made it very easy for him to invest in his water basins.

Making investment decisions.

The core factor in Ruud's decisions in the economic aspect of an investment, but he explains that with scale enlargement, some things cannot be done with manual labor anymore. Replacing labour with a machines brings structure and calmness in the organization: *"We doen heel veel op economische basis, maar op een gegeven moment zei ik tegen Kees: Ik kap ermee, ik kan het niet rondrekenen, maar we kopen hem gewoon, want rust kun je niet uitrekenen. Maar we zijn nu twee keer zo groot geworden, en nu kunnen we het wel rondrekenen. Maar misschien hadden we deze uitbreiding nooit gedaan als ik hem niet gekocht had, want dan was er minder rust/tijd geweest. En zo heb je wel meer dingen".* If some investments are not profitable yet, they may be in the future, due to a volume increase of products. Moreover, Ruud argues that 'dumb labor' is best be replaced by machines: "*Er was vraag naar. Je moet geen dom werk gaan doen. Alles waar ik een betaalbare machine voor kan kopen om taken te doen, dat doe ik. Dom werk is voor mensen natuurlijk ook niet leuk, en de arbo vindt dat ook niet goed. Met 7 ha, daar kun je niet meer tegenaan werken".*

Concluding, the story of Ruud portrays a grower who is very active in cost leadership strategy and employs dominantly process innovations. In his case, this cannot be assigned to a believe that marketing innovations are not useful – as Ruud does underlie this – but can be assigned to his inability to do so. Ruud explained he does not have the right contacts, skills and knowledge to develop value-increasing innovations, illustrating the social barriers to value-increasing innovations. Moreover, his story shows how his process-aimed investments were stimulated by formal institutions; as the regulations of the municipality stimulating the use of substrates and the GMO subsidy prohibiting individual marketing activities in general.

6.2.3 Jos Looije

"De mensen die ik toen heb leren kennen, zitten veel nog op de een of andere manier in die samenlevingsverbanden die ik heb. Dat heeft en band geschept, en we hebben ook gestreden, om teelttechnisch verbeteringen te bewerk stelliggen. Je bent jong en je kunt zoveel aan. Het was een kwestie van elkaar stimuleren, we hebben wat afgediscussierd, dat wil je niet weten. Dat was goed voor het bedrijf, het maakt je hoofd scherp en het verlegd grenzen. En nog steeds nu. We communiceren met elkaar met veel psychisch geweld. Omdat je elkaar zo lang en diep kent, en veel van elkaar weet kun je ook enorm je geest verzetten met elkaar, je denken verzetten met elkaar. En daarom is die groep mensen heel erg belangrijk in mijn leven, die me echt verder geholpen hebben, met nieuwe ideeen".

Jos is the owner of a large greenhouse company, with a total of 15,5 hectares in the Netherlands and an additional plastic greenhouse of 8 ha in Spain. Around 200 temporary employees and 28 permanent employees are active in his greenhouses in the Westland. His organization is well known in the sector for its innovative marketing approaches and unorthodox strategies. Besides his greenhouses company, Jos is co-initiator and owner of several organizations that support his company - as well those of his partners. These organizations are centered around employment, technology, seeds and energy. These cooperations with fellow-growers were set up to make sure things were done well; decent employment, trustworthy technology and energy buying and selling for decent prices.

Bulk & marketing

Jos' story is a special one, as he has quite different ideas and strategies in his organization compared to other growers in the region. His story is special in the sense that his organization is both large-scale as well as very innovative in marketing (which is seen as incommensurable by many) . Where many others see cost-price reduction as the core strategy to survive for large tomato-greenhouses, Jos has chosen a tomato based on its taste, accepting 25% less production. Moreover, where many see innovative marketing strategies solely effective for smaller organizations operating in small-scale niche markets, Jos has organized his own supply chain and branding. The price he had to pay for setting up his own brand, was the decision to stop working with Fresq, thereby missing out on GMO subsidies.

The story of Jos his life gives an insight in how he came to be the entrepreneur he is today. Important family members, experiences when he was a boy, hard lessons in his life, and special relationships with colleagues formed him, and enabled him to act differently than most of his colleagues. In the next sections, the factors that broadened his scope, the people who pushed him beyond his boundaries, and crisis's that made him rethink his actions, will be described a more extensive.

Important people

Jos' story starts with his father, who influenced Jos a lot, as he stimulated Jos to read many books and to look beyond horticulture. Jos addresses this to the broad development of his father:

"Mijn vader was bijzonder op twee manieren; hij is met de oorlag naar Indie geweest, en hij heeft verschrikkelijk veel gelezen. In de winter las hij een boek a 4 a 5 per week, alle onderwerpen. (..) Toen hij naar Indie was geweest, bleken de waarheden die hij had meegekregen, minder waar te zijn als dat hij dacht".

His uncle also played an important role in his life, as Jos assisted his uncle at the market in his childhood. He has been selling crops directly to consumers for years, already developing a commercial feeling at the age of 15. Moreover, his uncle stimulated him to stick to one goal and get better at it, and develop his entrepreneurial characteristics:

"Mijn oom was de broer van mijn moeder, en ik ontdekte bij die man dezelfde dingen die ik ook had; dat ondernemende, overal kansen zien, steeds mogelijkheden zien.(..) *Ik heb van die man geleerd, dat je tijd nodig hebt om te kunnen leren, dat gaat niet van de een op de andere dag. Topsporters hebben de 10.000 uren regel voordat ze ergens echt goed in zijn. Hoe langer je het doet, hoe beter je er in wordt. Bij die man heb ik jarenlang, van mijn 9e tot mijn 15e, elke week meegewerkt op een markt. Dan was het 2,5kg aardappel afwegen, een kilo appelen, en een potje andijvie en een krop sla afmeten, inpakken en afrekenen. Ik moet zeggen dat dat wel geholpen heeft in een stukje commercieel gevoel".*

With a traveled and well-read father and an entrepreneurial uncle that brought him into touch with consumers, Jos was raised in an environment that wasn't solely horticultural. After his education in horticulture, Jos decided to get another education in social pedagogy, which widened his scope even further:

"Toen ben ik sociale pedogogiek gaan doen (pedagogisch leraar). Mijn vader stimuleerde dat, gaf me daar ruimte voor. Ik moet ook zeggen dat dat heel belangrijk is geweest in mijn leven, je krijgt wat wetenschapsleer, je krijgt verschillende stromingen, statistiek, iets als kans en toeval, wat is valide, en echt leren waarnemen. Niet alleen mensen, maar ook in het algemeen leren observeren, waarnemen en analyseren. (…) *Dat heb ik ook echt toe kunnen passen in de teelt. Het helpt overal; ook bij werknemers en consumenten begrijpen. Die opleiding is een belangrijk moment geweest in mijn leven. Ik ben redelijk concreet, maar het helpt je wel, als het nodig is, als je iets abstracters leest of ziet, om dat een plaatsje te kunnen geven. Telers zijn relatief laag opgeleid; gemiddeld. Zoiets helpt wel. Ik heb niet heel veel gelezen als je het vergelijkt met mijn vader"*

The value of his education, as Jos puts it, is that he developed the capability to think at abstract levels, and that he learned to observe and analyze – which he could apply not just on people, but also on horticulture, employees, consumers, and the market as a whole. His education helped him to look at problems and chances in different ways, and helped him to evaluate what he saw. Jos his father encouraged him to do so, stimulating to develop his social capital further, enriching his capabilities, knowledge and network. In the interview Jos expressed i that he sees a link between his innovate organization and his extended social capital.

Contact with consumers

Jos' curiosity brought him to England to examine the local, looking at the shelves, the products, packaging, and consumers. Jos drove to the Island annually to understand the English market better.

"Wat ik ook ben gaan doen is het volgende: ik ben in mn auto gestapt, op de boot geladen en ben 's ochtends in Engeland van de boot gestapt en daar een stuk of 20 supermarkten bezocht. Ik ben naar die winkels toegegaan en gekeken wat daar gebeurt; de indeling van het tomatenschap, waar mijn eigen producten liggen, waar die van de andere liggen, naar de retailprijzen, waar ligt het in het schap, naar de mensen die er langslopen en tomaten kopen en kiezen. Ik vraag ze eens; waarom kies je nou die tomaat? Niks wetenschappelijks, gewoon kijken wat er gebeurd, en wat er speelt. Ik kom nog steeds vaak in supermarkten om gewoon te kijken."

His trips provided him valuable insights in the supermarket, on the products of competitors and thereby on the position of his own. Moreover, he would talk to consumers and ask about their purchases to gain a better understanding about consumers. Jos shows very innovative social behavior in the sector, as he crossed the social boundaries between production and sales, which have been strongly present for many years. Moreover, he uses strategies that are very uncommon and are described by others as unprofitable. His believes on the best way to make a profit are different , therefore being his actions on different 'information'.

Difficult times

Jos explained that a crisis in his life helped him to overcome routines and believes he used to have: "*Die crisis heeft me daarin geholpen, ik ben dichter bij mezelf gekomen en is het makkelijker geweest die stappen te zetten die nodig waren toen. Ik ben toen bevrijd van mijn verleden*".

A personal as well as business-related crisis helped him to re-think his actions that used to be routines and ideas taken-for-granted. Especially the step to set up an organization in Spain made him to reconsider his actions, as the things he had learned and done unconsciously in the Netherlands turned out not to be useful in Spain, due to the different context. It made Jos more conscious about his actions and ideas, as he had to redefine his organization in Spain:

> *"Spanje was een ervaring die me losmaakte van mijzelf. Het belangrijkste wat ik geleerd heb is: een mens doet het grootste gedeelte onbewust in zijn leven. Hier in Nederland ging het al best goed, in het bedrijf en in het doen en laten. Dan kom je in Spanje; natuur is anders, cultuur is anders, en omdat de omstandigheden zo anders zijn, gaan er zoveel dingen fout omdat je onbewust beslist over dingen. Hier kan dat; je kent de situatie. Het heeft me er wel in geholpen bewuster te leven en na te denken; wat doe ik nou eigenlijk allemaal, en wat onbewust? Dat proces heeft mij echt geholpen".*

This personal insight of Jos touches exactly on the power of social institutions, as the shared information, strategies and norms prescribe legitimate guidelines for individuals and are confirmed by other members of a network. Moreover, these institutions are very powerful as they are taken for granted and therefore not questioned. The story of Jos shows how his set of information, routines and norms clashed in a different context, forcing Jos to reconsider them consciously. The crisis situation forced him even more to do so, as he wasn't going to make it personally and in his business.

Close cooperation

In the time Jos was growing English Beef tomatoes, he developed a special relationship with a couple of other growers active in the same tomato. Until now, the relations with his colleagues have played an important role in his personal and professional life. The discussions – that can be very harsh, personal and emotional – would stimulate him to take steps that transcend him.

> *"Dat heeft en band geschept, en we hebben ook gestreden, dat het teelttechnisch niet goed ging, dat het een strijd was. Je bent jong en je kunt zoveel aan. Het was een kwestie van elkaar opfokken en stimuleren, we hebben wat afgediscussierd, dat wil je niet weten. Dat was goed voor het bedrijf, het maakt je hoofd scherp en het verlegd grenzen. En nog steeds nu. We communiceren met elkaar met veel verbaal geweld. En omdat je elkaar ook zo lang kent weet je wat er allemaal gebeurd in een mensen leven. En omdat je elkaar zo lang en diep kent, en veel van elkaar weet kun je ook enorm je geest verzetten met elkaar, je denken verzetten met elkaar. En daarom is die groep mensen heel erg belangrijk in mijn leven, die me echt verder geholpen hebben, met nieuwe ideeen".*

> *"Ik weet zeker dat die discussies ons allemaal verder gebracht hebben. Als je emoties loskomen in discussies, dan komt er meer los in een mens, dan als je alleen rationeel afwegingen maakt. Als je het emotioneel maakt, komt er meer uit".*

The discussions that could be of verbally violent character brought him further in his thoughts then he would have been able to by himself. In his case, Jos benefits from the social capital he had developed over time, gaining close and valuable relationships with peers.

A lot in Jos' life story contributes to the explanation why he is the innovative grower as he is now, but Jos stresses that the crisis in his life helped to go over the 'hurdle' of structures and habits he used to have. The

crisis made him to break free from ideas and strategies he used to have before, and forced him to make substantial decisions.

> *"En dat heeft te maken met een crisis die me dan net over die hobbel heeft heengeholpen, ik moest toen keuzes maken om het goed te laten gaan. Die klap die was er, dat heeft mij over die grens heen gezet dat ik alleen wilde verkopen; dat wil ik zelf doen, niet met een ander. En die ervaring dat ik ook een half jaar aan de telefoon heb gezeten die dingen te verkopen, voel je ook wat er gebeurd, begrijp je het ook. Het zijn een hoop dingen die invloed op me gehad hebben, me dingen geleerd hebben, maar die crisis was nodig eroverheen te stappen: nu moet het echt anders. Die hobbel zijn de structuren en gewoontes die er normaal zijn".*

Decisions

Jos has made some decisions after the crisis he was in that can be considered as very innovative in the sector. These decisions, or social innovations, will be discussed in this section.

GMO

The GMO subsidy has been around for a while, but Jos was able to sell his products under his own brand since 2002 while cooperating with Fresq. However, two years ago, he made the decision to abandon the subsidy. Jos had to make the decision due to stronger supervision: "*het juridisch niet meer doen vanwege strengere controles over de GMO. Ik verkoop het nu zelf, en probeer zelf te bouwen aan verbindingen met consumenten. Door meer controles vanuit de EU, kon het niet meer. Toen moest ik kiezen: of helemaal bij fresq en niet meer zelf verkopen, of eruit en zelf doen. Onder druk van die controles*". Jos his story portrays a self-conscious grower making the decision to leave the subsidy that is experienced by many others as a 'must have'. This shows that the subsidy is not used by all growers, but that some do refuse to take is, as their strategy of individual branding would not be possible. Despite the large sums of money he may miss, Jos believes his strategy aimed at marketing and value creation is the right way forward. Thereby, he takes on an innovative strategy and contradicts a shared strategy of making use of the GMO subsidy.

Currently, Jos his organization special in the sense that he that sell under his own brand and makes contact with consumers directly: *"van de 350 tomatentelers in Nederland durf ik te zeggen dat ik de enige ben die het volledig doet, en er zijn er nog 10 die het in tussenvormen zoeken, op de grens van de regelgeving*". Other brands are sold via the conventional supply chain, while Jos has found his way around it. There are three other large organizations that plan to abandon the GMO subsidy in 2013, Jos explains, foreseeing some changes in the sector.

For Jos, his own branding meant he could not be connected to sales cooperations that do receive GMO subsidies. For large organizations that have bulk-products, as in the tomato-greenhouses, this is a decision with great consequence. Therefore, most growers make use of the subsidy, which means that for this majority, individual marketing activities are forbidden. Just in some cases, growers make the unconventional decision to reject the GMO subsidy and choose for the freedom.

Honingtomaten©

Tied to the decision not to make use of GMO, Jos developed his own brand and supply chain around the common supply chains. Jos has been in contact with consumers his whole life, as he had been selling crops on the market already at the age of nine. Later on in his life, he drove to England to look at the supermarkets and talk to consumers. This made him look at his product from the consumer perspective, and he developed his believe in the value of taste – which would allow him to ask a higher price. After tasting a special type of tomato, he decided to make all the 'disadvantages' of the tomato for granted and started growing his new brand:

"Wat gebeurde er: ik liep er in de supermarkt, en ik zag daar troscherry's liggen, iets kleiner dan de mijne, en ik werd erdoor getriggerd, en ik denk: die koop ik. Ik stapte in mijn auto, pakte die tomaat, en steek hem in mijn mond. Ik had echt iets van; wauw, dat is gaaf! Dat wil ik ook! En toen had ik uitgezocht wel zaadbedrijf dat was, dat is Gautier. Deze tomaat heeft een lage productie, veel werk, moeilijk te telen.. Maar lekker!"

This decision can be called unique in the sector, as the desirability of a tomato-type is strongly tied to the productivity of the tomato, which is 25% less in the case of the Honingtomaten©. This has scared of many peers: *"De soort is ook bij andere telers geprobeerd, maar ze zijn allemaal het bos ingestuurd omdat de kilo's minder zijn: wel zo'n 25%minder per vierkante meter als vergelijkbare tomaten".* Jos his experiences in the English supermarket and with consumers made him confident that the superior taste would make the Honingtomaten© profitable. These insights and believe are based on his experiences with consumers, which many of his peers do not have, identifying an important variable for Jos his innovative behavior.

When Jos decided to change crops, he showed innovative behavior as he broke through several social institutions that are shared by the majority of growers in the sector. First, he *believed* that marketing can also be beneficial for his bulk products, where others would only combine value-increasing strategies it to niche products. Also, he developed an innovative *strategy* to increase a higher value for his products, diverging from the dominant and shared strategy to of 'cost-leadership' – whereby not competing by lowering the market prices of his crops, but on quality and identity of his products. These strategies are based on other *norms* and *levels for success*. Not just cost reduction and yield per square meter are variables for success, but also the superior taste of the products, consumer approval and higher market value support his strategy.

His new strategy does not stand on itself: Jos his *activities* have changed too. A new activity for Jos was stepping in his car and driving to the supermarket to talk to consumers. This is innovative in several ways; he crossed the quite strict separation between producers and consumers that had been present in the sector for a long time due to the auction system, and later – sales cooperations. Moreover, most growers work solely in their greenhouse and if they go out - often visit other greenhouses. Jos his activities are therefore innovative when it comes to the *location* of the supermarket he went to as well as the *new contacts* with consumers he began.

Concluding, the experiences, education and family members raising him enabled Jos to look at horticulture from a different perspective. After he continued developing new ideas and experiences, setting up an organization in Spain and visiting supermarkets, giving him new insights and helping him to develop new believes, norms, and activities. As Jos his strategy, believes and decisions diverge from the norm in the grower community, he displays social innovation in the sector.

6.2.4 Fam. de Boer

"Ik vind dat wel leuk, dat kleine, dat hele grote trekt mij niet, dat 40 hectare tomaten, en dan zo goedkoop mogelijk proberen te telen, ten opzichte van de buurman. Dan werk je in een fabriek. Het is bij mij nog wat gemoedelijker".

Preferring small scale

Not all growers followed the trend of scale enlargement in the past decades. As De Boer explains; some don't have the money, some are not capable, and others do not like the large scale horticulture, as himself. De Boer sees differences between those groups; those growers that want to grow, create big companies and compete fiercely on cost price, and others that went the other way and stayed small. His explanation why he likes to stay small, is that his parents used to have a small organization and stress the importance of social aspects of life: *"Waarschijnlijk ook omdat ik als klein jongetje dat heb gezien; ik denk dat die zonen van die telers met 40 hectare net zo snel zoveel bijbouwen, omdat ze dat kennen. Ik denk het wel dat je doet wat je ouders deden. het heeft te maken met het sociale, dat het een beetje leuk en gezellig moet zijn. Dat rationeel werken op grote schaal, dat doen ze ook niet allemaal. Dat sociale vind ik wel belangrijker".*

The organization of De Boer grew to 2 hectares, despite his preference for small scale: *"Door omstandigheden ben ik ook groter geworden, en daarom heb ik 2 hectare, ik heb die markt een beetje opgebouwd. Dat is wel mooi, maar het is ook een beetje en fabriek geworden. Dat vind ik wel eens lastig. Het is allemaal wel leuk, maar dat kleinschalige trekt mij ook wel weer".* His story shows he had to compromise between his ideal of a small greenhouse, leaving space for social life and room to move in, and on the other side to take the necessary steps to stay competitive in the market. Many growers address this dilemma between the need to grow as a result of market developments and the wish to keep the greenhouse organization small. De Boer has chosen to remain his horticulture on small scale, shifting to crops that would allow him to do so, thereby giving priority to his preference over the pressure from the market competition.

De Boer has grown a lot of different crops in his greenhouse over the years; tomatoes, paprika, melons, lettuce, and radish. In the start of the eighties he moved from tomatoes to paprika, which was quite unknown in the sector at that moment. He decided to change when the tomatoes where not that profitable anymore. His strategy was to change crops, while many others increased their scale and mechanized their production to bring down costs: *"Voor ons was het overstappen meer een leerproces, want sinds dat we deze teelt hebben, zijn we niet meer veranderd. Dat is mijn ding, ik heb altijd iets gezocht wat een ander niet had, wat goed in de markt lag"*

De Boer ran into the problem that when a product or technology is successful in the sector, the idea is quickly copied by other growers, spreading the innovation rapidly and diminishing the special position of the innovative grower: *"Paprika was er toen niet zoveel, maar dat groeiende en toen had binnen een paar jaar iedereen paprika. dus toen had ik het toch niet naar mijn zin en ben ik naar meloenen overgestapt".* As De Boer could and didn't want to compete on cost price level as the large organizations did, he choose to move to another crop that would still be relatively new, to be able to run his organization in the way he and his wife preferred.

De Boer's values and ideals about his organization are different from many other growers, who do not have problems with the mechanization and scale-enlargement, but like the 'professionalization'. Some of the other growers –mainly the older generation – do feel the same as De Boer about the loss of authenticity of organizations, but did went along with the trend for their own reasons. For de Boer, this sense of what could perhaps be called nostalgia was decisive for his decisions. His example portrays the tension between nostalgia and personal values, and the rapid changes in the sector - demanding 'modernization' of growers. In the case of De Boer, he had to change to other crops to maintain small, as many successful small-scale crops are picked-up and spread in the sector, or even lifted to large scale. One of the current issues in the sector is that almost all

segments difficulties as low prices and overproduction occur, which makes the switching to other segments less interesting. In the next paragraph, de story of de Boer shows how institutions may be violated to find a way out of the issues in the sector.

Protection on market position

The crop de Boer cultivates is a niche product, which allows him to make enough profit out of the higher margins and lower volumes. Additionally, he has treated and packed his crops in such a way that it is a specific segment that has a higher volume on the market. As with other products, some other growers changed to his product, which meant he had to share the market with other growers. His buyers started asking other growers to make the same product as de Boer, but for a much lower price, playing the growers off against each other and dragging the market price down.

De Boer decided to talk with his competitors to see what price they were getting for their crops, which was much lower than he did. His competitors went back to their buyers to ask for a higher price (and got it). The result was that De Boer retained his competitive position, and the other growers got a higher price for their crops. Also, they discussed about their market share, which did mean he lost some of his sales volume to others. What the story of De Boer shows, is a self-organized mechanism amongst the growers in this segment to counteract the decreasing market prices of their products. As these activities are forbidden in the Netherlands by the NMA, formal institutions are violated, risking high fines. De Boer has still decided to do so, as those developments created problems and inequalities in the sector, where the growers as himself would suffer from the most.

Many growers express their incomprehension about the power of the NMA and the high fines they risk when they would discuss issues in the production, sales and prices in the sector. Recently, growers were given penalties of several million euros after inspections by the NMA. Many growers are angry, and argue that they try to solve the severe issues in the sector, rather than trying to get more money from the consumers. Many growers are afraid to get the fines by the NMA, as they are very high.

The example of De Boer shows how a grower may decide to take the risk of violating the rules of the NMA. The pressure of the new entering players in his market segment and the development of the mechanism in which growers are traded off against each other brought him to make this decision. If he would not have talked to the other growers, he would probably be in trouble, as the market segment would have changed. The other growers would have dropped their prices, De Boer might have lost his clients to others, and the market price of the crops might have decreased close to the cost price after the trading the growers off between each other. The decision to talk with his peers prevented this economic mechanism and enabled him to continue his business as he had been doing - keeping his product and remain the small greenhouse organization.

The willingness to accept the risk may lie in that the other option – losing his clients and having to lower his prices or change products – might have been the worst of the two.

Reasons to innovate

De Boer explains a bit more about the way he innovates and how he decides to choose for a certain type. His case shows how innovation decisions are made at the interplay of institutions and personal strategies.

First, he stresses the importance of the effect of the investment on the cost price of his crops, but adds that those innovations that improve the work situation of people, this may also be a viable reason to do so: **"***Een innovatie is een goede innovatie wanneer hij werkt, op financieel gebied, ja of sociaal natuurlijk: makkelijker werken. Maar als het een sociale kant heeft en het geld moet kosten, moet het bedrijf wel goed lopen, dan kun je zeggen; het is een goed jaar, misschien wel goed zo'n lopende band te kopen. Dat kan alleen in goede tijden*". De Boer explains that his decision for an innovation is not solely dependent on the financial

prospects, but also to make his organization more professional, which he defines as 'sustainable, in line with regulations and socially sound'. This implies that norms on what professional organizations should realize also affect his decisions. However, investments that are not obviously economically attractive can only be made in prosperous times, thereby forming a condition for social investments, as De Boer explains.

Second, some innovations are realized after the government enforced growers to adopt certain changes. These investments would in all probability not have been made otherwise, as many of them are not financially attractive and therefore not be implemented voluntarily: *"Voordat het echt wat mag kosten, een innovatie, dan moet het een verplichting zijn. Dat zijn investeringen die je doet omdat je het moet doen. voorbeelden daarvan zijn het water dat op je dak valt, dat moet je opvangen in watersilo's. Als het in de sloot terecht komt, is dat slecht. Die wetgeving is langzaamaan ingevoerd, dat is heel geleidelijk gegaan, het beleid van de overheid gaat in kleine stapjes, die moet je niet voor zijn kop stoten, maar laten wennen en dan laten accepteren. maar je moet wel aan die eisen voldoen. Eigenlijk wordt er veel opgelegd van buitenaf wel als je er zo naar kijkt: anders zou het regenwater nog rechtstreeks de sloot in lopen en zouden we nog dmt gebruiken".*

De Boer shows that regulations are often effective, but that they should be enforced gently and allow the grower some time to comply. Also, he stresses the differences many growers make between smaller investments and larger ones; De Boer – like several other respondents explained that would more easily consider investments that are not clearly economical to improve working conditions or environmental performance, but for larger investments and changes, regulations are 'needed' for them to invest.

An example of a cheap innovation initiatied in the sector are sprayed plugs at farms: *"Soms geven telers het zelf ook aan, net zoals in de landbouw bij de spuitsystemen, daar hadden de boeren de buitenste spuitdoppen aangepast. Toen de overheid het zag, werd het verplicht gesteld. Als ze zien dat het kan. De ene keer loopt de overheid vooraan, de andere keer achter denk ik".* In those situations, regulations are changed after the best practices. This shows that the strategies of growers also affect formal regulations, as the regulative bodies adopt best practices as the norm.

While some growers see innovation as an important part of their activities, making their work more interesting, De Boer sees an innovation as a result of problem solving. He explains he innovates, only when he is confronted with a problem – thereby making a balanced decision on it. This differs to the innovation strategies of some others that like to 'innovate to innovate' or innovate to relief tax payments, are make use of the GMO subsidy: *"Innovatie is iets dat op je pad komt. Als je op een gegeven moment bezig bent met iets, dan werkt het niet, dat moet dan anders, en dan krijg je het eureka moment. dan denk je hé, is dat wat? Als er iets niet naar je zin is, ga je zoeken naar iets dat wel naar je zin is, dat is dan innovatie. Dat komt voort uit een probleem. Of je ziet wat bij een collega, en kun je wat op een andere manier toepassen. Maar het komt altijd vanaf de andere kant, vanuit het probleem, je gaat niet innoveren om het innoveren. Als je al een paar jaar een plan hebt, van dat heb ik altijd al willen doen, dat zou dat kunnen, maar dat koop je ook niet zomaar en kost een hoop geld".*

Decisions

De Boer has changed to different crops quite some times, and has searched for those crops that where new or in a niche market. His strategy allowed him to stay small, as he could make a living from the somewhat higher margins, rather than from the volumes as many other growers did. With his current crop, his position came into danger when buyers started playing off growers with the crops he was cultivating. What is interesting in his case is that he discussed prices and market shares with other growers, to prevent their segment to lose its somewhat higher margins, risking high fines. His strategy shows how he attempts to maintain the way his organization can exist, balancing thereby his personal values about his organization with a profitable strategy that fits it (niche product). His decisions for innovations are nevertheless strongly determined by their effect on

the cost-price, but also by their social significance. Moreover, De Boer explains that he innovates as a way of problem-solving and as a requirement through regulations.

6.2.5 Fam. Scheffers

"Ik vind innovatie heel mooi, maar innovatie in de bulk daar geloof ik niet in. Je hebt al zo'n overschot in product, en het is een kwestie van keihard doordraaien tot je omvalt. Maar de bank houdt velen overeind, dus dat gaat ook niet meer op. Waarom kijk je niet om je heen en ga je wat anders proberen, een ander product? Dat is natuurlijk heel moeilijk, dat doe je niet zomaar. Ik denk dat 95% van de tuinders zoekende is, maar er rendeert niets, dan kun je zoeken, maar wat ga je dan doen? En je bent gespecialiseerd met je spulletjes. Dan kun je wat anders gaan doen; maar je moet je bedrijf omgooien, je mist de kennis, die moet je inkopen bij derden, en moet je maar afwachten of dat het gaat worden, het is een sprong in het diepe".

Aron and Adrienne run a greenhouse with Carhtamus. Before, they were growing radish, but after Germany started growing their own (cheaper) radish, only the production in summertime could be continued. When in Italy even cheaper radish was being produced, they had to make a decision on whether they wanted to continue with radish. Some competitors decided to continue, and started increasing their scale to be competitive on cost price. Others moved to Italy to take on the competition in the same conditions. They decided to start cultivating other products, as they were not keen on up-scaling their greenhouses to competitive sizes. Scheffers decided to step over to flower (Carhtamus) production, and potatoes in winter time:

"Bij ons zat er bij de radijs geen rendement meer in, dan kun je twee dingen doen: overstappen of schaalvergroten, maar op schaalvergroting zit ik eerlijk gezegd niet te wachten, daar geloof ik niet in. Je moet een bedrijf hebben die bij je past, laat ik het zo zeggen. Dan moet je 10 mensen aansturen, zo ben ik niet, ik wil het liever zelf doen. Dus ja, dan heb je een relatief klein bedrijf, dan ga je andere keuzes maken, en dan zeg je; doordat je in de winter geen producten hebt, hebben we vanaf de zomer er een keer aardappels gezet. En de buurman zei; joh, dat doet het niet meer. Maar wat kun je er aan verliezen, niks daar, dus heb dat gedaan. Dus die aardappels waren goed, die hebben we lopen uitventen en verkopen, en de mensen vonden het leuk, en mooi".

The cultivation and sales of potatoes in winter time went well: people bought potatoes directly from Scheffers. Customers started asking also for other products and subsequently, Scheffers started producing other crops in their greenhouse. The happy faces and customers coming back are motivations for t Aron and Adrienne, as they see the reaction of their consumers for the first time. However, their way of working also has its difficult sides, as it had become very labor-intensive and the profitability of the concept is not proven yet. The case of family Scheffers shows a strategy that is very much based on the personal values and ideals on what the organization should look like. Like in the case of Fam. De Boer, Fam. Scheffers were forced to find a solution when their product was picked up by large-scale greenhouses, as also decided to step over to other products that would still allow them to remain small.

Small versus large-scale

Aron describes two very distinct routes growers can take when the profits go down in a certain crop: increase volumes or change to another crop when scaling-up is no option. These descriptions show the way Aron explains the situations and defines the possibilities to choose from in two categories. This has subsequently effect on his perceived choices he can make. The decision space for growers has changed over the decades, he explains. Halfway the past century, people used to cultivate multiple crops, the volumes where relative small, as where the investments in the greenhouses, as they were not fully mechanized and specialized on one specific crop. Later on, in the seventies, eighties and onwards, the trend of scale enlargement and specialization made the greenhouses optimized for the efficient production of one crop. Many growers focused

on the production of one crop, and moved away from a differentiated production. This made it increasingly hard to change to another product: "*Als je zwaar gespecialiseerd bent, dan zeg je niet snel; we gooien het aan de kant, dan vernietig je kapitaal. je bent wel heel flexibel als je dat niet doet. Een jongen met 10hectare is niet flexibel, die moet zijn teelt afdraaien, en dan de volgende, en de volgende: er is niet te switchen in die grote bedrijven*". His choice to stay small and keeping specialized investments down makes it feasible to change a production and stay flexible. The quote illustrates his view on large organizations and the risk involved there.

Another issue of changing the production lies in the saturation in many segments. Before, it was possible to step over to another crop if the profitability went down of one crop. However, the sector as a whole is now in bad weather, which makes a switch to another crop a risky business: "*Die jongens kiezen ergens voor, en die hebben wel hele moeilijke jaren gehad, maar die zeggen ook; wij hebben hiervoor gekozen, hierin geïnvesteerd, wat moeten we anders? Al die teelt, tomaat, chrysant, paprika; alles staat onder druk. Dan hebben we die ene teelt wel verlaten, maar wat gaan we dan doen? Dan moet je noodgedwongen met je teelt door, en dan hopen ze dat het over waait".* Aron explains that staying a small and flexible organization is beneficial when coping with uncertainties.

Scheffers decided to stay small and flexible. However, he decision to stay small also has it downsides: if the new or niche product becomes more mainstream – which happens often due to the quick copying and spread in the sector – small growers cannot compete with the larger organizations, as their cost price is higher. Moreover, small organizations have been looked down on 10 to 15 years ago. The norm in those years was to increase scale and lift on the flourishing economic developments of that time. As many might have followed that trajectory and shared that norm, some other chose or were forced to remain small organizations. These latter growers have faced social resistance, as they did not get the same respect as their larger peers receive from each other.

Moreover, larger organizations could purchase for better prices, and would benefit from GMO: *"Nu respecteert iedereen elkaar nu het slecht gaat, maar dat is wel anders geweest. De grote telers hadden het meer voor het zeggen, die konden goedkoper inkopen, en de kleintjes hadden het voor het nakijken. Je ziet gewoon dat grote bedrijven GMO subsidie pakken".* Also the auction system is disadvantageous for smaller organizations, as the price is paid per cart: *"Je ziet ook dat bij de bloemenveiling op bulk gevaren wordt. Je zit natuurlijk met je veiligkosten, hoe minder per kar, hoe duurder. Met een breed assortiment is het onmogelijk, door de veilingstructuur wordt dat heel duur; daar moet je elke keer voor betalen".* This shows that the innovation strategies are not only affected by norms, shared strategies and personal preferences, but also by characteristics in the sector making large scale production more practical and beneficial.

Decisions

Despite the downsides of staying a small grower, Aron and Adrienne chose to stick with their small greenhouse, cultivating multiple crops and selling directly to the consumers. Their explanation for their decision is that this type of horticulture is to their preference. Before, Aron gave up his job to be at the greenhouse fulltime and see his family more: "*Volg je hart. En tuurlijk moet je geld hebben, maar wat is geld? als ik een miljoen heb en je gaat met tegenzin naar je werk. geef mij maar twee kwartjes en dat ik een leuk leven heb. waar kies je voor? Je maakt die keuze wel met zijn allen, met mijn meisje*". For Scheffers, his and his family's *personal values* were leading for the decisions on their organization.

The developments in the sector troubles Aron, companies are growing in size and many small organizations lose the battle from large ones. With the recent problems in the sector, Aron sometimes thinks the future lies in the value-increasing and activity-extending strategies he is employing, but on other moments he believes the current trend may result in the dominance of several huge dominant organizations in the sector. He, just like other growers, has to deal with the uncertainty about their sector, and on which crops may be successful. As the whole sector is suffering and in risk of bankruptcy, greenhouses with deviating sizes and

strategies are gaining more legitimacy and respect: "*Je hoort collega kwekers wel zeggen; 'joh, wij weten ook niet waar het zit'. Tomaten hebben hele slechte jaren gehad, flink ingeteerd op hun eigen vermogen. Die hebben ook geen grote mond meer om te zeggen: daar zit het. Het is allemaal moeilijk*".

The guideline he and his wife take to deal with future uncertainty is to *follow their heart* and develop their local shop further and see whether it will work out: *"Soms denk ik dat de toekomst hier ligt, en soms daar bij schaalvergroting/bulk gaan. Dat zijn de twee richtingen. Die bulkbedrijven slaan hard om zich heen, de aantal telers met 60% gedaald, maar het areaal hetzelfde gebleven. Veel kleintjes vallen om; de verkeerde kostprijs en het wordt alleen grootschaliger. Dat is realiteit, het maakt niet uit wat ik er van vind. Ik zeg; volg je hart; dat klopt altijd".* The way different growers look at possible strategies turn out to differ quite a bit, which are likely to have a large impact on the perceived decision space. Scheffers distinguishes between two distinct trajectories, while De Jong saw cost reduction as the one way forward. Jos Looije explored a complete new strategy combining both scale and marketing. What can be learned from this, is that the believes of growers on how profit can be made in the sector is a very important factor in their decisions, as it pre-defines the considered options.

Family Scheffers is still cultivating both their flowers as well as the crops for their shop. The shop and reactions of their customers give them a lot of rewarding, but the shop has to be profitable to make a living, for their family with three daughters: *"Je moet echt keuzes maken, dit is heel arbeidsintensief. We zullen een keuze maken, gaan we voor de bloemen of voor de groenten, want dan zouden we de groenten moeten uitbouwen, om er meer rendement uit te halen. Misschien is de volgende stap een koerier is, die het komt ophalen, maar wij moeten hier blijven. Je hoort veel mensen: goh wat leuk, jullie doen het goed, ga zo door, en dat is leuk. Maar daar koop je geen brood voor, ik heb 4 meiden thuis. Dan kan ik het wel mooi vinden.."* Though Scheffers showed in their example that their personal values are an important factor for their choice of strategy, they are dependent of the success of the organization for survival, which makes the profit of the organization as the core aim. Stated differently; Fam. Scheffers prefer value-increasing and activity-extending strategies, but will not proceed in this trajectory if these strategies do not create enough margins to sustain their household. It shows the other side of the tension between personal preferences and requirements to be commercial successful; portraying an organization shaped based on personal preferences rather than on the requirements tied to the process of modernization.

Their innovation strategy is therefore not based in adopting the newest technologies, as the purchasing of expensive technologies is not feasible in his organizational situation. The innovation practices of Sheffers can therefore be identified as socially innovative, as new organizational concepts are explored. Their focus lies in finding the niche markets with new ideas, as a vegetable drive-inn at a local school: *"wij hebben van het voorjaar hebben we een groente drive-inn gedaan, bij een school. dat vind ik creatief en innovatief. Het probleem is dat je het de gelegenheid moet geven om het te laten slagen. dan moet je daar een jaar gaan staan niet 12 weken. Je kunt ook niet alle tegelijkertijd in een bedrijf".* The issue they have as a single-operating organization is the time they have to divide between the cultivation, shop, transport and external initiatives.

Concluding, Family Scheffers took another trajectory compared to many other growers, by staying small and searching for new niche markets to sell their products. The underlying strategy is to stay away from bulk products and thereby be able to stay small and distinctive: "*Je moet je proberen te onderscheiden, het maakt niet uit hoe je het doet, als je het maar doet, je moet weggaan bij die massa".* In that way, he is able to make a living in horticulture, enjoy the freedom of being his own boss, being home a lot with his family, and keep the scale of his greenhouse small – which fits his ideal.

6.3 Discussion on the field research

The case studies portray the stories of five different growers, who are all in their own way trying to find the right way to manage their horticulture business. They all have to deal more or less with the same institutions and sector conditions, but have sometimes quite different believes, experiences, believes. Also, they differ quite a bit in their size, the way they are connected to other growers, the way their products are sold (bulk/niche products) and the extend in which they have contact with consumers. These differening variables result in quite different strategies of competition and innovation strategies. Relating this back to the four strategies of competition, as discussed in chapter 2, the growers employ different strategies of competition through a decision making process involving both personal as institutional influences.

In this discussion on the outcomes of the fieldwork, I will discuss the main variables influencing the decision making of growers on innovations that emerged from the fifteen interviews of the growers. Many of these variables have already been discussed in the five illustrative cases of growers. Explanations will be provided that are based on the fieldwork information and explanation by growers and experts.

Strategies of competition

A relevant distinction that can be used to understand the variety of organizations can be found in the strategies of competition used by the growers. In general, the larger and more conventional organizations employ the cost-leadership strategy as the core strategy, while in other organizations, strategies based on differentiation are used to escape the harsh cost price competition that puts pressure on the organizations. The interviews showed that the central applied strategy of competition is an important reason for growers to employ innovation strategies that are generally connected to those strategies of competition. This means that growers active in bulk products, drawing upon 'cost-leadership' competitions search for innovations that bring down their cost-price and increases the production even further. Growers active in niche markets - drawing upon the 'differentiation' strategy – may also employ innovations that bring down their costs, but also invest in value-increasing and product-extending innovations, such as marketing strategies.

The stories of De Vries and De Jong provide illustrative examples of growers working hard in their large horticulture organizations to stay competitive – continuously struggling to bring down their costs. De story of De Jong showed how the fierce competition on prices stimulates investments strategies that are based on risk-reduction, cost-reduction and efficiency. This leads unsurprisingly to process-aimed innovations, as these improve efficiencies. Furthermore, their return-of-investment is easy to calculate by the growers - who are experts on horticulture processes, which reduces the (perceived) risk of the investments. The continuous pressure on the prices of the perishable bulk products, draw the attention of these growers to the processes and costs of their products. Nevertheless, other growers have showed other strategies may work.

The stories of the Boer, Scheffers and Looije show organizations employing strategies that help them to stay away or 'escape' the fierce price competition. These three examples show how the growers have tried to find a way to generate higher margins by *increasing* the value of their products, employing the differentiation strategy. Scheffers operates in a niche market, selling a unique product with special characteristics, which makes him less interchangeable and the value of his products higher. Family De Boer are selling the variety crops from their shop attached to their greenhouse. The small scale home-grown crops that customers can also pick themselves have a higher value, due to the authenticity of the crops, and the extended services of their organization. The supply chain is minimized to a producer selling directly to consumers, allowing the producer to get higher margins, as the intermediary organizations are missing. Although these strategies are well known to niche segments, these business models have become scarce in the horticulture sector that has known a trend of 'modernization', implying scale-enlargement and mechanization. Maintaining a small greenhouse and using 'differentiation' strategies may in the light of this modernization trend be called socially innovative.

The strategies Jos Looije applies in his large-scale greenhouse are both process-aimed as well as aimed at increasing the value of the products; Jos produces in large quantities in a highly efficient greenhouse, but has based his decisions for a tomato not on its production performance, but on its superior taste. Because Jos brands his tomatoes as a superior product, this enables him to ask a higher price. It is unique that a large greenhouse organization draws on a differentiation strategy, developing a whole now sales channel outside the conventional market structure. Preceding to this decision, Looije drove to England to understand his market and consumers, got into contact with merchandizers himself to arrange his sales, and rejected GMO subsidies to be able to sell under his own label; Honingtomaatjes. Alltogher, Jos displays very socially innovative activities, drawing upon deviating believes, experiences and values – altogether leading to a unique business model that can be called innovative.

Informal institutions

In the interviews of chapter six, the growers with less conventional business models explained they experienced that their practices sometimes conflict with social institutions present in the horticulture sector. The stories of Fam. De Boer and Jos Looije illustrated growers that deliberately chose to not to comply with *formal* social institutions. Looije had to disconnect from sale cooperation Fresq and reject the attractive GMO subsidy to be able to sell under an own brand, Honingtomaatjes. In the case of De Boer, to combat the mechanism of being played out by merchandisers and getting into the stream of cost price competition, he violated the regulations of the NMA, by discussing prices and market shares with peers.

However, the *informal* social institutions diverging growers have to overcome are perhaps even more challenging and varied. Scheffers and De Boer have decided to stick to small-scale production while 15 years ago, small growers were looked down on, as scale enlargement and mechanization where the *norm.* The large organizations were making a lot of many, out-competing many small less efficient greenhouses, ridiculing them for their 'outdated' strategies. Scheffers and De Boer both explained that they felt more comfortable with a small scale, more authentic greenhouses, leaving room for social interaction. To be able to stick to their ideal, they did have to face the disapprovement of some others who did go along with the trend of up-scaling and mechanization. This is also tied to the *believes* on what a profitable way of running an organization is: many growers that where interviewed stated that 'to stand still is to go backwards', which would equal economic decline.

Scheffers and Looije made the step all the way to the consumers, entering new social relations and crossing conventional *societal structures*. Looije drove all the way to England to look at tomatoes on the shelves in the supermarket and talk to consumers. Fam. Scheffers decided to set up their own shop and also tried to sell to consumers by setting up a drive-in shop at a primary school. In the context of the Westland, these are innovative activities as the supply chain used to run via the auction hall, separating the production side from the sales organizations. In the auction system, the producers had to ship their products to the hall, after which on afterwards, they would get a receipt that stated how much they had earned. This meant that the focus of the growers was drawn to their production, the quantities (and the quality to some extend) as this would affect their income, not encouraging them to look further than the auction hall – to the consumers.

Therefore, taking the step to ask the consumer directly what they want, looking at the production from a different angle and perspective is not very common and often labeled as innovative in the sector. As De Vries and van De Jong Explained, they are used to work with standards as Kg/m2, €/m2, and €/Kg cost price, having a strong focus on the internal processes of the cultivation and management of their organizations. Taking the step to ask consumers for their wishes, and move away a bit from production efficiency towards, for example, a new concept as consumers' experience, allowing the customers to pick their own crops, is held to be very innovative.

Nevertheless, the line between what it held to be possible and what is actually possible is very thin. The reasoning often goes that there are two directions in horticulture production: bulk production and niche production. Bulk production is tied to large scale greenhouses and cost price competition, while niche markets allow smaller scales and higher margins. The example of Looije is special in the sense that he managed to

combine bulk products with marketing strategies and selling tomatoes with a higher value on a large scale. However, his strategy may not work if all growers employ this strategy of specialty crops. This shows that a strategy for one grower may be very successful, while it may not be the answer for all. Jos Kersten (LTO Glaskracht) explains:
"Er is nu en scheiding tussen ondernemers die voor de niche gaan en die voor bulk blijven draaien. Want een supermarkt heeft gewoon zoveel ton tomaten nodig, in bulk, dat is gewoon nog nodig. Kleine zoete segmenten, of biologisch, daar moet gewoon meer voor betaald worden. Tot de jaren 90 waren er duidelijke scheiding, nu is er meer ketensamenwerking. En degenen die dat goed kunnen, die halen het deel waar ze recht op hebben naar zich toe, maar hoe de rest terecht gaat komen, is altijd wat lastiger, omdat die duidelijke scheidslijn weg is tussen producent en markt, er komen nieuwe verbindingen".

Formal institutions

GMO

"De stucturen hangen af van GMO, het heeft veel invloed op de verkoopstructuren waar we nu in werken. Het is zo dat onze cooperatie bijna ondergesneeuwd wordt door dat klote GMO. Dat we eigenlijk onder de verkooporganiatie een aparte dochter onderneming willen zijn, en met GMO kon dat niet meer"

The quote illustrates the contradictory attitude growers have towards the GMO subsidy. On one hand, the subsidy helps the grower financing their investments, but at the same time, the subsidy is heavily criticized on its negative effects on individual as well as on sector level. The critiques named by my respondents are: a) the unnatural growth of production in the sector leading to over-production; b) the vast influence it has on the sector structure and cooperations through the 'rules' tied to the subsidy; c) the restricted freedom of those receiving the subsidy and the potential punishments when violating conditions; d) the large differences it brings between those that do and do not make use of the subsidy; and e) the strict rules about the uniformity of the products of the cooperation and prohibition to employ own marketing activities outside of the cooperation.

Most growers recognize the disadvantages of the subsidy, but perceive its benefit to be larger. The 'free money' allow them to purchase more and more expensive technologies which helps them to improve their competitive position – which is very much needed in this sector of fierce cost-price competition and overproduction. This explains the fact that although the GMO subsidy is criticized by most respondents, the great majority of growers acknowledged they made - and still make - use of the GMO subsidy.

However, as dominant as the subsidy seems, not all growers make use of it, as some growers are not connected to cooperations, are small greenhouse enterprises acting independently in a niche market or do have the right size - but have made the conscious decision not to apply for GMO subsidy to avoid the conditions tied to the agreement. In these cases, the growers do not receive the benefit of having 50% of their investments covered, but do still have the freedom to sell their products under own branding and marketing strategies. What can be learned from this, is that the types of innovations compete with one another; if a grower wants to maximize his process-innovations, GMO subsidy is very helpful – but this inhibits the potential of own branding. Similarly, those growers that want to maximize their differentiation strategy cannot use GMO subsidy or be connected to the cooperations that receive this subsidy, which means that they have a large disadvantage when it comes to process-innovations; they miss out of the subsidy that covers for 50% of the investment. The institutions threaten the compatibility of the innovation strategies, which provides an explanation on why the less conventional (and popular) innovation strategy is used less.

NMA

Similar to the GMO subsidy by the EU, the regulative institutions by the NMA are critisized by most respondents. The goal of the NMA is to enable free trade to safeguard the availability of cheap and high quality

products for consumers, therefore setting the preconditions for free trade and fining those organizations that break the rules. The main critiques on the policy of the NMA are on the effects the regulations have on the potential of organizations to agree upon shared strategies to address issues. The regulations forbid growers to discuss or form agreements on prices and market shares amongst each other. This means that no shared strategies may developed to counteract the current economic problems as overproduction and the poor margins growers yield with their products. The growers argue that the interests of consumers are over-protected, while protection of producers in the horticultural sector - and agricultural sector in general – is lacking. This would be desirable or even necessary due characteristics of the sector; the use of perishable bulk products, and the supply chain in which producers have a vulnerable position.

The massive penalties the NMA uses to enforce its institutions bring many growers to despair; the risk is too high to discuss solutions for the problems in the sector and in their segments. The example of Fam. De Boer tells the story of a grower that violates the regulations of the NMA, to safeguard the product prices he used to have with new competitors entering his segment. The widespread problems in the sector make it much harder for growers to change crops as a solution. For De Boer, the risky conversations he held competitors provided a solution to stabilize the product prices – allowing him to continue is small horticulture organization in the same way. This shows that the despair or lack of other options brig growers to the point they are willing to risk massive penalties from the NMA.

Grower cooperation

There are large differences between growers in how they cooperate with colleagues and the way growers decisions are effected by colleagues. The two contrasting stories of growers discussed below show how the differences in the *social network* growers are embedded in, may make a large difference in the way their innovation practices are stimulated:

One of the respondents, Jos Looije, explained the value of the discussions that are held between him and his colleagues. He stresses the importance of the closer relationships he has with other growers, as these close colleagues help him to improve his business, by discussing both private as business issues: "*De Westlandse cultuur is wel wel direcht, echt direct. De grofheid, het verbale geweld, dat gaat wel heel ver. Het is gewoon heel diep doordenken en doordiscussieren, en stemverheffing, en met emotie. Er wordt ook verwezen naar dingen die in je privé-leven gebeuren. J**e** kent elkaar zo lang, en je weet zo goed wat er gebeurd, je ziet heel veel in elkaar"*. Discussing with other growers helps to reduce the risk of *bedrijfsblindheid* (organizational blindness). Organizational blindness means that persons in organizations have a tendency to think in beaten tracks, do not see inefficiencies, are inward-focused and apply the same solutions to problems. Discussions with colleagues, as Looije describes, proved him a very effective way to look at his organization and issues in a different way. His colleagues help him by being very critical sometimes, forcing him to overcome his own ways of seeing and doing things.

The other side of the close cooperation in the sector is that there is a risk the organizational blindness may occur on a larger scale, on 'cooperation blindness' or perhaps even 'sectorial blindness'. The cooperations of growers are often based on a shared view or the same crop: similarities rather than differences. This has the effect that when growers discuss issues with colleagues, the solutions may be similar to what they might have come up with: "*Bijna elk bedrijf van deze grootte is identiek, omdat die manier de beste en goedkoopste manier van produceren is. Er wordt veel naar elkaar gekeken, tomaten telers kijken allemaal naar elkaar, men houdt elkaar in de gaten. De sociale controle is groot denk ik, er wordt vooral gekeken hoe er geinvesteerd wordt, want het is natuurlijk moeilijker om te kijken naar personeel. Om die reden wordt er vooral gekeken naar de investeringen, in schaalvergroting, de kassen die gebouwd worden, en technologieen*" (Interview with Rokien Schenkeveld). The visibility of scale-enlargement and technological innovations as the installation of a CHP makes it easier to notice and copy these innovations.

Another respondent had a bad experience in the past and decided not to cooperate anymore with others. In his case, his decisions are very little influenced colleagues, but rather by the values of his family members: "*In het verleden heb ik ook samengwerkt met anderen dat ging helemaal fout. dat is een les die ik getrokken heb, dan heb je wat baggage bij je en denk je; laten we het de volgende keer lekker alleen doen. dit verhaal is 20 jaar gelden; te makkelijk erover gedacht, van we kennen elkaar wel, dus het komt wel goed. maar je kent elkaar wel wat oppervlakkig, en dan ga je elkaar toch anders kennen. als er dan relatief niet veel verdient wordt, krijg je toch wrijving".* Many growers like their independence as an entrepreneur and value the freedom to make their own decisions. The types of cooperation a grower is involved in effects the decision making also on innovation practices, as will be described in the next paragraph.

Cooperative decision-making

Many growers are a member of a cooperation, in which joint decisions are made on investments and directions of innovation. The joint decision making has the effect for individual growers in the sense that new activities are employed that are the result of a decision on the whole group – not by the grower individually. Nevertheless, the grower is required to invest in it as a member, and will subsequently benefit from it too. This mechanism has an influence on the innovation practices of individual growers, as well as of groups of growers.

On group level, tough discussions between the members, a middle ground has to be found when it comes to investment decisions. This sometimes has the effect that the extremes of individual members' wishes and ideas lead to a strategy that addresses the middle ground. Moreover, important topics are in cooperations are often dived in work groups addressing different tasks with other interested growers. The study groups may contain more extreme views, but in discussions and voting, the joined initiatives are often smaller adjustments, especially when it comes to marketing, as a substantial part of the members is reserved when it comes to marketing: "*Er vinden behoorlijke discussies plaats binnen de vergaderingen. Dat is wel interessant, want er zit een behoorlijk spanningsveld tussen marketing en verkoop. Tomatenverkoop is in grote mate daghandel, korte termijn. Wij [marketing] denken dan na over volgend jaar, wat gaan we doen? Hoe pakken we dat aan? We moeten natuurlijk als marketing club ons verhaal vertellen aan alle telers, die zijn nog minder marketing georienteerd. Dan pak je onderwerpen, en presenteer je dat, en dan krijg je gemopper, anderen kijken de andere kant op. Je moet het wel waarmaken, het moet in een keer goed zijn*" (Interview with marketing expert active in cooperation). The quote illustrates the variety of perspectives that may be present in a cooperation, and the struggles that may take place, when a working group of marketing presents new suggestions. This is partly based on the differences between greenhouse organizations.

Not all growers have the same wishes in a cooperation, as these are often tied to the type of product one works with. The tomatoes of bulk type gain less advantages than smaller tomato types, as sherry tomatoes: "*Ik kan wel groepen identificeren, en je kunt het eigenlijk al een beetje zien aan de tomaten die ze telen. Niet helemaal, het is een beetje gechargeerd, maar cocktail telers zijn 9 van de 10 keer meer gericht op marketing dan een teler die groffe tomaten teelt. Je ziet ook dat tasty tom meer verdient aan tomaten dan wij, alleen door marketing; de tomaat is niet beter of lekkerder, maar het is puur marketing. Dus er zijn voorbeelden van, maar bij groffer is het wat minder, daar is het meer; hoeveel grof kan ik telen op een m2*". The tension between members with different wishes and products may hold more extreme innovations back, but those joint innovations that are taken by the whole group, may also 'force' more conservative growers a step further than they would have gone otherwise.

The different examples in the interviews show that often, growers start a cooperation with peers active in the same production. This seems to have multiple effects. First, the cooperation based on similar products does not always imply a cooperation based on similar perspectives and wishes. The variety in such a cooperation may stimulate the cross-pollination of the best practices in different strategies amongst organizations. However, the mechanism of joint decision making may also 'neutralize' the ideas of the most

innovative members, and on the other end of the range, stimulate more conventional members to join in the shared investments in innovations.

The close cooperation of growers may therefore have the effect of homogenization. The collaboration on daily basis stimulates the sharing the same information, defining shared goals, sharing solutions to problems and best practices together, the chance of isomorphism is higher than those growers working individually, or in segments of products that have less clear norms of professionalism, as when starting a new shop, which is a new concept in the sector. The norms that are shared between growers, especially within close cooperations, affect the decision-making. Some of the respondents said they felt it was very important what other growers think about their organization. Especially the way the organization looks, inside as well as the outside of the plot and greenhouse, should be neat and well arranged, as it reflects the management of the organization.

Education

While norms and strategies are often transferred from one generation to the next, the educational programs on horticulture are a source of new ideas and innovation. The director of one of the programs explained that the students sometimes run into problems when working in an existing organization and develop a new perspective on school: "*Dat is soms een ernstige handicap dat ze thuis een bedrijf hebben: ze zitten vast aan de structuur van het bedrijf, en hoe het thuis is. Dat is hun wereld, en dan ziet hun wereld er op die manier uit. Dan is het onze taak om ze die andere kant te laten zien*". As the interview with Hans Ligtenberg illuminated, education programs may disrupt the transmission of conventional norms and strategies from a former generation to the new generation, as new perspectives are taught, stimulating the youngsters to do things differently.

The clash of social institutions as conventional norms and strategies and innovative perspectives in the education may take place in the classroom, but are also discussed at the kitchen table at home of the students: "*We krijgen altijd terug dat ze aan de keukentafels discussies hebben gevoerd, en we hebben ook hier veel discussies met koppige studenten die vasthouden aan bepaalde overtuigingen, want pa zegt het".* These educational programs are an important source of change in the sector, through the new generation of growers. The reason for this may be two folded; first, the newest insights and innovations are taught at these schools, providing the students with new insights, influencing their believes, norms and ideas on suitable strategies in the sector. And second, as the youngsters are new to the business, they do not have to overcome the routines, believes and norms that may have become indissoluble and more difficult to replace for growers of older generations.

Personal preferences

Many respondents discussed their personal preferences, ideals and personal life history to explain the developments in their organizations. The young Eric de Jong had an ideal picture of the organization of his father he entered, aiming for the modern standards – and acted upon those ideals. Family de Boer and Family Scheffers stressed their preference to maintain the size of their greenhouses small, allowing them to stay active in the cultivation processes, not having to hire (to many) employees. Their arguments stressed that the organizations should 'fit' a growers preferences and values, and that in their case – they did not want their greenhouse to grow into a 'factory'. De story of de Boer even shows a risky violation of regulations observed by the NMA, to protect their market position and greenhouse size.

Jos Looije also made his decisions on both his preference to base his competition on superior taste and high quality, rather than on the continuous reduction of product prices. However, his decision is also based on his believe he could do so. Not all growers made decisions in line with their values and ideals. Some growers, mostly the older growers, explained they did go along with the trends of scale-enlargement and mechanization, but did miss the smaller greenhouses they used to work in when they were small. This may be called nostalgia,

but it may also be negative externalities resulting from the economic trends in the sector. Some growers described their situation as being trapped in the developments, stuck in the cost price competition, having just one way forward towards further scale enlargement and mechanization.

In the interviews, some of the growers stated their disconnection with the developments and size of the organizations. Some exposed their fondness of walking around in dirty cloths, working in the workplace of the greenhouse, which would not be possible anymore when becoming a manager of a large-scale organization, as that would require a focus on management level. Moreover, emotions as fear where connected to the horticulture companies exceeding 'human scales' as 50 hectares and above: "*Het gevaar ontstaat dat als je dermate grote oppervlakte gaat creeren, dat je mistoogst, of niet optimaal kunt produceren, die angst neemt wel toe, het zijn enorme oppervlaktes. En het is zo dat een dubbeltje besparen kost veel moeite, en een euro verliezen met een stukje minder optimale teelt, is zo voor elkaar*". Some growers decide to stay small and look for other ways to make profit, as producing niche products and selling crops to consumers directly, while other do go along with the trend. In both cases, the strategy the grower's organization is based on may conflict with personal ideals, but may be continued as some growers perceive there is no way out of the path they are in.

Altogether, this shows that the decisions of growers are affected by many variables; the situation of the organization they are in, their believes, ideals, life stage, cooperations they are in, and the way the presence of both formal as informal institutions is incorporated. The different examples show that these variables play a role in the investment decisions of all growers, but have a different weight. These individuals strategies and actions will be used in the following chapter to provide explanations on the emergence and persistence of system phenomena.

7 Transformational mechanisms: innovation outcomes

7.1 Introduction

The horticulture sector is facing some issues, as became clear in the conversations with growers and other actors active in the sector. The competition on cost-price is taking its toll, as the margins on products are brought down to a minimum, leaving the growers with little financial room to try out new things and make mistakes in. The innovation efforts aimed at process efficiency often reduce the value of the crops produced, rather than increasing their value. Moreover, the benefit of selling for a lower price is temporarily, as most growers are continuously looking for ways to reduce their costs or increase volumes to be able to sell for a lower price. While many of these disadvantages of this dominant innovation strategy are known by many growers – it remains the dominant strategy for competition and innovation.

In this section, I will try to explain how the patterns on system level - that are described as being problematic and undesirable - rise from actions and interactions of growers who - from their standpoint - act in a fully rational way. Transformational mechanisms are used to provide potential explainnations on *how* these undesirable phenomena arise from individual (inter)action, giving insight in the social workings active at the interaction of the system and the individual.

The outcome of this chapter is the identification of plausible transformational mechanisms that can be used to explain how the macro-phenomena in the horticulture sector arise from individual (inter)action. These mechanisms can be of special value to agent-based modeling, as they can provide the explanation of how emergent patterns come about in the real world. This emergence of phenomena in the field is interesting to understand, but become even more useful when these patterns can be explained through social mechanisms. The research of Lansing on the water temple system in Bali in his book 'A thousand years in Bali' shows how modeling outcomes and social research can complement each other in explaining social patterns. Lansing created a model using geographic, biological, and social data, displaying the exact appearance of the water temple system, indicating the right locations, water use and sharing systems (Lansing, 2006). It is the description on social relations, culture, ceremonies, symbols and behavior that explains *how* such optimized social systems can come to being, while the modeling showed the geographic patterns of the water temples (Lansing, speech). Similarly, in the next section, I will provide explanations on how behavior may give rise to patterns, which can be used to make a model or to use it to triangulate outcomes.

The writings of Merton on unintended consequences are used to embed the explanations, as the macro phenomena discussed are of undesirable nature, and unintended by the actors. A distinction is made between the intended actions of growers in individual level - often resulting in the desired outcome level - and the outcomes on systems level that for the study of the problems in the horticulture sector, turn out to be disadvantageous for all.

In this section, the analysis on the horticulture sector via bathtub model is completed by explaining in return how the action and interaction on individual level adds up to emergent phenomena on macro-level. I will explain how the innovation practices of the growers lead to the sector characteristics that are indicated as being problematic. The analysis will therefore give a comprehensive view on the system dynamics in the horticulture sector, based on research on institutions and decision making strategies of growers.

7.2 Unintended consequences

The problematic system phenomena that result from the actions of individuals may be explained with theoretical work on 'unintended consequences'. With unintended consequences I mean the unforeseen consequences of purposive action (Merton, 1936). The effects do not have to be identified as undesirable, although they may seem undesirable from the perspective of an outsider, as in some activities in the horticulture sector.

Actions with harmful consequences may be fully rational from the perspective of an individual, as the intended result of an action may be 'the lesser of two evils', seemingly undesirable but desirable related to the

alternatives (Merton, 1936). In the case of the Westland horticulture sector, the issues on system level as identified before originate from the actions and interactions of individuals. The explanation of the actions may lie in two lines of reasoning. Actors may be aware of the effects of their actions, but decide to proceed with it, because it is the best option of all options (or the lesser of two evils). Reducing the selling price of crops under the cost price is unfavorable, but not selling the products at all is even worse for an organization. Another explanation on these activities is that actions of a grower give the intended outcomes on individual level therefore being legitimate on actor level, but the actions of many actors altogether add up to unintended and unforeseen consequences on macro-level.

The study on unintended consequences raises some difficulties, as on how to link action and consequence. The consequences of purposive actions are limited to those elements in the resulting situation that are exclusively the outcome of the situation (Merton, 1936). In this study on the horticulture sector, the macro-level phenomena emerging from the individual action and interaction are the consequences studied. The definition is harder to use when researching the macro-effects of the sum of individual actions, as the cause- and effect relation is harder to identify.

There also lies a difficulty in the purposiveness of actions, as many actions may be part of a routine and thereby done in a more mechanical way. Also, actions may be distinguished in unorganized action of individuals and formally organized actions, that are done in common purpose with like-minded others (Merton, 1936). This distinction is interesting when explaining behavior of actors active in a cooperation or as an individual, as different decision mechanisms are at use. In this study, I will focus on the decision and activities directly related to investments and innovations in the greenhouses, and the effects these have on the sector as a whole.

The social mechanisms that will be used to explain the social workings, are those related to the unintended consequences as discussed by Merton. Five categories of social errors will be used to explain the occurrence of unintended macro-outcomes of grower activities (Merton, 1936):

1. *Ignorance* It is impossible to anticipate everything, thereby leading to incomplete analysis as one cannot know everything about an situation.
2. *Error* An incorrect analysis of the problem or following habits that worked in the past but may not apply to the current situation, causes outcomes that were not expected. Procedures that have attained legitimacy as they have worked before are repeated in all circumstances, while they bring success in some specific cases. Old wants may be blocked in a new situation due to rigid procedures are kept.
3. *Immediate interest*, which implies a competition between interests, whereby short-term interest may override long-term interests. The immediacy of interests may draw the concern of the actor to pressing immediate consequences, away from the consequences on the long-term. Economically, short-term requirements seem more urgent and are easier to understand and calculate. Moreover, the strong satisfaction of immediate interest, and the failure to engage in required calculations on the long term, may cause unintended consequences on the long run.
4. *Basic values* Basic values may require or prohibit certain actions even if the long-term result might be unfavorable. The felt necessity of certain actions causes no consideration of further consequences. The actions tied to basic values are therefore not evaluated by the objective consequences, but with the satisfaction of the duty well performed. In return, these long-term consequences may eventually cause changes in basic values.
5. *Self-defeating prophecy* the fear of some consequence drives people to find solutions before the problem occurs, thus the non-occurrence of the problem is not anticipated.

The social errors causing unintended consequences of action can provide an explanation on how the system level problems occur from flaws in individual (inter)action. In the next sections, three system-level phenomena that are described as being problematic are further examined; the innovation efforts leading to decreased product value, overproduction and homogenization of greenhouse organization. Again, these explanations are transformational, linking individual actions to macro-level patterns. As an agent-based model aims to explain the same emergence, it is valuable to compare the outcomes of a model with the social explanations on the consequences of actions.

7.3 Spiral of decreasing product value

The decision-making of growers is generally described as rational by themselves, basing their choice for investments on the calculations on the return-of-investment of an innovation. When deciding whether to innovate or adopt an innovation, calculations on pay-back time and profits are the core element in making investment decisions. Some of the respondents stated that the investments bringing down the costs of their production process, having a short payback time is the only way to properly innovate:

> "*Bedrijven met een niet-ideale kostprijs en bedrijfssituatie die gaan gewoon afvallen. Als ik zorg dat in mijn bulk bedrijf mijn kostprijs beheersbaar hou ten opzichte van anderen, heb ik een langer bestaansrecht. Zo zit de wereld in elkaar, en zo kom je tot het idee dat deze methode de enige juiste methode is*" (Jan van der Voort)

Nevertheless, these very innovations reducing the cost-price of growers, thereby increasing their margins, have some additional unintended effects on macro-scale. As the competition is 'cost-leadership' segments are based on low prices, the strategy of competition for these growers is based on reducing their product prices, thereby improving their competitive position compared to peers. However, this advantageous position is of short duration, as the novelties spread quickly in the sector, providing many others with the same advantageous position. This leads subsequently to the situation in which all growers have adopted the improving, but have also dropped their prices to stay competitive. The result of this is that the products are now sold for a lower price, leaving the growers with the same low margins as before. After the fierce competition on prices, all growers remain with the same low margins, while having larger sums of money invested in their organization. The *intended* consequences of the innovation practices are the reduced costs and reduce cost price, allowing individuals to stay competitibe. The *unintended* consequence of the innovation strategies are the decreasing market value of the horticulture products.

The unintended outcomes are the result of the economic mechanism at work, which is central to 'cost-leadership' segment. As the crops are perishable bulk products, the time pressure forces the growers to drop their prices before their crops perish. Merchandisers are able to buy products with the lowest prices, as the bulk products are easily replaceable, and the sales are under time pressure, forcing growers to sell within a short period. These pressures influence the decision that growers have to make on the price they will selling their products for. In times of overproduction, growers may lower their prices to be able to be competitive with others. The selling of products under the cost price (by some referred to as 'dumping') is a more extreme case, as it reduces the prices to harmful levels, as it draws the market price of products to levels in which growers make losses.

From an individual's standpoint, this would still be rational: it is better to sell the crops with some losses than not selling it at all. From a sector perspective, it would be better if nobody would sell crops close or under the cost price, thereby maintaining the value of the products on a healthy level. The question here is why growers would sell their crops for low prices, affecting the sector as a whole by it, backfiring also on themselves as the price is spoiled sector-wide.

The explanations seem to lie in a combination of the social errors of *immediate interest, Error and self-defeating prophecy*. Economically, the short-term requirements of making enough money to survive have a

preferential position compared to long-term needs. The investments and running expenses are often so high in the greenhouse sector, that a lack of income or decreased income has severe effects for the organization. The urgency of the *immediate interest* of growers to reduce losses, affects the market prices in a negative way. Moreover, the selling of products may be a required action that is motivated by *basic values* as saving the organization, safeguarding the jobs of employees, not throwing food away, etc. The influence lies in the felt necessity of certain actions, and the satisfaction of the duty well performed.

Furthermore, the success measurements that were relevant in the times of the auction hall, do not apply in the same sense anymore. The explanation of the *error*, implying the *´incorrect analysis of the problem or following habits that worked in the past but may not apply to the current situation'* relates well to the deeply embedded routines of growers to focus on production issues, not dealing yet with market concerns. The process-aimed strategies were very useful in the auction system, but now the market structure has changed; these strategies alone will not do anymore, as growers have also become responsible for their sales. Lastly, the error of *self-defeating prophecy* may come into play when growers expect others to sell under cost prices, anticipating on this by doing so first, inflicting the damage to the sector themself.

This latter mechanism is central to the phenomenon of the 'tragedy of the commons', and has been applied to markets by Ostrom (Ostrom, 2005). The tragedy of the commons, which is often defined as '*the dilemma arising from the situation in which multiple individuals, acting independently and rationally consulting their own self-interest, will ultimately deplete a shared limited resource, even when it is clear that it is not in anyone's long-term interest for this to happen'.* The resource may in the case of the market not be an actual resource that is depleted, as it entails the market value of the products. However, the mechanism behind the tragedy of the commons does give a good explanation on the actions of individuals: the individuals are pursuing their own interest, following their independent rationality of their situation, altogether causing issues as macro level.

The need to choose for the immediate interest to sell products and generate an income seems to be based on characteristics of the typical horticulture organization. The modernized, mechanized and large-scale greenhouses are capital-intensive, while the margins of the products are very small. The running expenses are high due to labor costs, pay off of investments, high heat and electricity bills, which demands for continuous income. As one grower stated, '10cents profit (per Kg) is very hard to realize, but an euro lost (per Kg) is easily done'. Small fluctuations in the cost-price of crops have tremendous effects, as the volumes are huge. The lack of 'flesh on the bones' gives the organizations little space to move and take losses, which demands a focus on short-time issues in the greenhouse. Moreover, the products are perishable, which means that the sales cannot be extended as would be possible with non-perishable products.

Another issue that helps to explain the down spiraling product prices, is the lack of coordination and communication about selling prices, due to the fragmented sector in combination with the regulations from the NMA forbidding coordination and price-related discussions and agreements. The 'common pool' on sector level is too large to overcome the tragedy of the commons, as self-governing efforts as discussing minimum prizes are fines with penalties of millions of euros. Within cooperations the 'community' is often small enough for social control to be affective, and is to some extend allowed by the NMA.

7.4 Overproduction

A remarkable outcome of the fieldwork is that almost all respondents (growers and non-growers) displayed a very negative opinion about the GMO (Gemeenschappelijke Markt Ordening) subsidy from the European Committee, while many of them did and still do make use of it. A major critique is that is creates unnatural innovations, leading to unnatural growth in the sector, subsequently causing overproduction. Moreover, the low prices in the sector are partially the result of overproduction: "*Subsidies zijn ook een bedreiging, omdat je groeistuipen gaat creeeren binnen de sector. Ik denk dat andere manier van financieren, zoals GMO, met wet en*

regelgeving vanuit Brussel, die zijn geimplementeerd. Dan zie je dat je enorme groeistuipen krijgt, en daar plukken we nou de wrange vruchten van, omdat we nou die overproductie hebt"

Again, the issue seems to lie that at first, growers individually benefit from making use of the subsidy. However, when everyone does, the relative or net benefit is zero, while everyone has invested and scaled-up. Many growers criticize the subsidy, but feel the pressure to take it, because if they do not take it while their competitors do - they are disadvantaged relative to others. Similar to the GMO, financial concepts as sale-and-lease-back contribute to overproduction: *"Je hebt bijvoorbeeld sale and lease back, dat is een nieuwe financieringsvorm waarmee je in staat bent meer meters kunt bouwen, met minder vermogen".* The incentives to scale-up and mechanize an organization seem to be greater than to abandon these opportunities to contribute to the solution of overproduction.

The GMO subsidy causes tension in the sector, and does not only contribute to overproduction. Other critiques named by the respondents in the interviews are plural. The explanation why growers would still participate in the GMO subsidy - despite their critiques and identified negative long-term effects - is similar to those on the effect of value reduction of innovations. The *immediate interest* of having 50% of an innovation covered by a subsidy over-rides the long term interest of optimizing the production volumes in the sector.

Furthermore, another explanation seems to lie in an *error* in the strategies applied. The sector is showing signs of arriving at a mature stage, which means the profit and potential, may not lie in conventional strategies - as increased scales - anymore, but rather in new, innovative concepts. The dominant strategies pushing towards efficiency, scale enlargement and value reduction have worked in the past, but seem to approach the end of their success. Relating this to the work of Holling on the adaptive cycle of systems, the system seems to have arrived at the conservation stage, in which connections are strong, and capital is fixed in large and dominant organizations. In the process towards conservation, connectedness and stability increase and a capital is slowly accumulated and sequestered (Holling, 1973). Competitive processes lead to a few 'species' becoming dominant, thereby also losing some of the diversity and flexibility of the system – increasing the vulnerability of it. Subsequently, the conservative systems may break down, giving room for new re-organization and innovation (Holing, 1973).

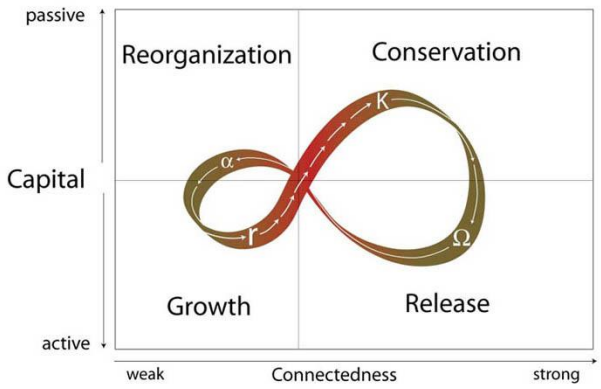


Figure 11 - Holling cycle

Applying this perspective to the horticulture sector, one may say that innovation practices that are still dominant today, have been very successful in the growth/accumulation phase (r-K) but reach the limits of their success. The habits and strategies that worked in the past may not apply to the current or future situation anymore, due to a change in circumstances. The continuation of strategies in a changing environment may result in an *error*, and may therefor produce unintended consequences: "*An incorrect analysis of the problem or following habits that worked in the past but may not apply to the current situation, causes outcomes that were not expected*". The continued use of conventional strategies and routines lose their effectiveness.

The changed environment is not only the maturation of the sector, but also lies in the organizational structure in the sector: the auction hall made place for cooperations and individual organizations, demanding new skills from growers. Also, the markets in other countries as Italy, Spain and Israel in have developed, making the cost price competition even more challenging, due to their superior climates for horticulture. Concluding, the environment of the greenhouse organization knew huge changes the past decades, and is still continuously changing. When the same routines and strategies applied that have shown to be successful in the past, may give unintended consequences, as they may have different effects in a changed environment.

7.5 Homogenization

"Innovatie is altijd wel moeilijk, je loopt voor de muziek uit, en dan moet je een heel persoonlijke overtuiging hebben om dingen te doen, om dat uit te durven dragen en al die kritiek te moeten ontvangen. Daarvoor moet je een sterke persoonlijkheid hebben, ik denk dat alle innovatieve telers dat hebben. Het probleem is vaak in de glastuinbouw, zodra je wat uitvindt, dan heb je daar 3 a 4 jaar moeite voor gedaan, en heb je wat nieuws, dat wordt binnen een maand gekopieerd, en dan krijgen ze stank voor dank. maar dat is altijd zo. dat zit in onze maatschappij. Juist omdat er probleem is wordt er gezocht naar oplossingen".

The quote addresses a problem that was identified in multiple interviews; successful innovations are quickly copied and spread in the horticulture sector. While this brings the overall sector a step further, the innovative grower loses his advantageous position quickly, which is described as discouraging for growers to 'stick their neck out' and take the risk of trying new things.

More general, the copying behavior has potentially a much larger effect via the process of homogenization. The risk of the close cooperation of growers seems to be increasing resemblance of organizations, also called the process of 'isomorphism'. This process, in which organization become more identical, may be the result of the copying of peers or results from the institutional constraints imposed by the state and the professions (Dimaggio & Powell, 1983). In this paragraph, I will both link influence of formal as well as informal institutions on the copying behavior of individuals.

First, the copying behavior of growers can be explained from their efforts to achieve rationality, while having to deal with uncertainty. The uncertainty is the sector has reached a peak, as the conventional strategies of scale-enlargement and mechanization are losing their effectiveness, and overproduction occurs in almost all segments, which means that the switching to another crop does not solve the problem. Growers in the interviews stated that they have no idea which direction will lead to success: "*wij weten ook niet meer waar het zit*". The copying behavior of growers can be beneficial as new innovations spread quickly amongst the organizations, once it has proved to work. The copying of others is indicated as *mimetic processes* by Powell and Dimaggio.

Uncertainty is a powerful source leading to copying of colleagues: "*when organizational technologies are poorly understood, when goals are ambiguous, or when the environments creates symbolic uncertainty, organizations may model themselves to other organizations*" (Dimaggio & Powell, 1983: 151). When the problems or solutions may be unclear, the copying of others may provide a viable solution for little expense. Alchan explains how innovation may rise from copying of organizations: "*While there certainly are those who consciously innovate, there are those who, in their imperfect attempts to imitate others, unconsciously innovate by unwittingly acquiring some unexpected or unsought unique attributes which under the prevailing circumstances prove partly responsible for the success. Others, in turn, will attempt to copy the uniqueness, and the innovation-imitation process continues"* (Alchan 1950, as quoted by Powell and Dimaggio, 1936: 151). The tendency of organizations to copy organizations that are similar to their field, as they are often perceived as being more legitimate or successful, has the effect the grower copy from other growers, often similar to their organization.

Second, in the interviews it became clear that growers closely cooperating with one another share similar ideas of what innovations should look like, and what strategies are rational ways to reach their goals. Because growers are cooperating who aim at the same goals, share similar ideas on professionalism, copying the best practices and cooperating on daily basis with one another, the organizations increasingly resemble one another. The different examples in the case studies show that some growers start a cooperation with those colleagues that share the same ideas. When collaborating on daily basis in a cooperation, sharing the same information, defining shared goals, sharing solutions to problems and best practices together, the chance of isomorphism is higher than those growers working individually, or in segments of products that have less clear norms of professionalism, as when starting a new shop, which is a new concept in the sector.

The strongly shared ideas on professionalism, including norms on what an organization should look like, what technologies should be adopted, and what the management should look like, are the social institutions that can be identified as normative pressures. This form of isomorphism covers the normative changes amongst organizations in a sector, and professionalization indicating preferential characteristics of organizations (Dimaggio & Powell, 1983: 152).

Dimaggio and Powell show the paradox of innovation and isomorphism: "*Once a set or organizations emerges as a field, a paradox arises: rational actors make their organizations increasingly similar as they try to change them*" (Dimaggio & Powell 1983: 147). The innovation efforts in the horticulture sector seem to have the same effect, as growers attempt to modernize and innovate in their organizations, thereby often adopting the same technologies, increasing the similarities. While a clear and often articulated goal is to gain efficiency in organizations, the gained legitimacy also plays its role: while for the early adopter, the increased efficiency is the effect of the innovation. While for the later adopters, the efficiency benefit may not be here anymore, but the adoption provides legitimacy instead: "*Strategies that are rational for individual organizations may not be rational if adopted on large scale. Yet the very fact that they are normatively sanctioned increases the likelihood of their adoption* (Dimaggio & Powell, 1983: 148).

An example of quickly copied innovation is the CHP's that were adopted by all members of Prominent, once it turned out to be successful. The copying behavior also has its downsides, as the copying of best practice makes the organizations uniform, decreasing the variation of organizations in the sector. This, in return, may make the sector more vulnerable, as similar organizations shared the same strengths and weaknesses. Moreover, the competition between organizations is reduced to minimal differences in cost price, as the organizations innovate from the same set of possibilities, realizing minimal differences compared to each other. Radical changes in organizations are most likely to occur between generations, as the youngsters are educated with new ideas and have the energy and combativeness.

The risk of the close cooperation in the sector is that there is a risk the organizational blindness may occur on a larger scale, on 'cooperational blindness' or perhaps even 'sectorial blindness'. The cooperations of growers are often based on a shared view or the same crop: similarities rather than differences. This has the effect that when growers discuss issues with colleagues, the solutions may be similar to what they might have come up with: "*Bijna elk bedrijf van deze grootte is identiek. omdat het de beste en goedkoopste manier van produceren is. er wordt veel naar elkaar gekeken. tomaten telers kijken allemaal naar elkaar, houdt elkaar in de gate. de sociale controle is groot denk ik. er wordt gekeken hoe er geinvesteerd wordt, het is natuurlijk moeilijker om te kijken naar personeel. er wordt daarom vooral gekeken naar de investeringen, schaalvergroting en de kassen die gebouwd worden*" (Rokien Schenkeveld).

Jos Scheffers explains how they saw similar growers in Brabant, but that they are the only one in the Westland growing the way they do: "*Wij werken eigenlijk niet samen. We hebben het in Brabant gezien. Zij doen hetzelfde als wij, maar dan biologisch en in een groep, en iedereen teelt een onderdeel. Die groep werkt samen, en delen een vrachtwagen*". Also, in a list of biological growers the Netherlands, just one out of the 22 listed is settled in the Westland (around 4%), which is remarkably low when looking at the high number of

Dutch growers settled in the Westland. In 2009, about 5478 horticulture organizations were active, of which 1033 in the region Westland-Delftland. This is 19% of the organizations settled in the Westland region (data: CBS). (Currently, the number of organizations is reduced to 924). The cooperation, shared culture and norms on horticulture may be an explanation for the low numbers of biological growers in the Westland, compared to other regions.

Third, isomorphism may arise from cultural pressure and pressure by other organizations: "*coercive isomorphism arises from both formal and informal pressures exerted on organizations by other organizations upon which they are dependent and by the cultural expectations in the society within which organizations function*" (Dimaggio & Powell, 1983: 150). The formal and informal social institutions and discussed in chapter four form clear 'pressures' on organizations. As the greenhouse organizations share the same environment, with organizations as the municipality, LTO Glaskracht Noord, the bank, but also the same regulations and subsidies, they are all steered the same direction. Many organizational changes in horticulture organizations are caused by governmental regulations, as pollution control and the reduction of (light) emissions. An example named in an interview with the municipality of the Westland, are the water tanks that became obliged for all greenhouses, regardless of the usefulness to the organization. The rule was created to enforce growers to make their water systems cyclic, thereby taking care of the water management:

"Er is bijvoorbeeld een regel dat tuinders een hemelwater bassin moeten hebben, ze moeten regen opvangen en gebruiken in de teelt. Dat betekent dat ze goed moeten kijken naar hun waterhuishouding, en dat ze ook een systeem moeten aanleggen waarin overtollig water wordt opgevangen om het her te gebruiken, zodat er geen mesttstoffen terechtkomen is het emissionair milieu: de bodem, het riool en de sloten. Er staat in de regulering dat elke teler een waterbassin moet hebben van 500cub per hectare, en dus niet erbij gezegd; je moet die andere faciliteiten erbij hebben om het water te kunnen recycelen. Dan hebben ze soms alleen een bassin, dan kunnen wij niks doen. Dat is natuurlijk gek. De regel gold al lang substraat telers en die hebben vaak ook die voorzieningen al om water te recycelen omdat het al lang verplicht is, dus daar zitten de problemen niet zo, er zijn maar een paar teelten die weinig water nodig hebben, die dat ding niet willen – want bij de grondtelers is de doelmatigheid helemaal niet aangetoond. Maar sinds 2 a 3 jaar is het voor grondtelers ook verplicht om dat ding te hebben, en daar zit heel veel weerstand. Ze laten het dan ook op een rechtzaak aankomen" (respondent, Gemeente Westland).

The effect of the policy was not as expected, as quite some revolt arose against the policy, sometimes leading to an installation of a non-used water tank. The strictly defined rule may bring negative outcomes: "*political decision makers often do not experience directly the consequences of their actions; and political decisions are applied across the board to entire classes of organizations, thus making decisions less adaptive and less flexible*" (Dimaggio & Powell, 1983: 150). The policy might have better worked if the water basin would not be obligatory, but if the regulations would address the performance of organizations on water management. Policies as the one in water basin example prescribe the exact required properties of a greenhouse, while more performance-oriented regulations would provide growers the freedom to come up with different strategies to comply with the regulations.

Concluding, the institutional isomorphism in the horticulture sector in the Westland may lead to homogenization of the sector, thereby reducing the diversity, flexibility and the resilience of a sector overall (Holling, 1973). The process of isomorphism in the sector can be explained through the three types, as discussed by Powell and Dimaggio. First, the ambiguity that reigns in the sector, tied to the economic problems in all segments of the sector, leads to uncertainty amongst growers, stimulating copying behavior. Best practices are often copied and spread quickly after been proved successful. Second, the close cooperation of growers in a community-like network leads to increased sharing of norms, information, ideas, solutions and innovations. Third, the shared environment of other organizations as the bank, municipality, LTO Glaskracht, suppliers, buyers and the shared set of social institutions give pressure to organizations to develop the same characteristics. The dominant supplying organizations - often initiating innovations – provide many growers

with the same innovations. Moreover, the harsh competition on cost price in the sector, embedded in the relations and strategies of sellers, forces growers in increasingly optimize the efficiency of their organization, through cost reduction and increasing the volumes. The innovations aimed at these goals remain therefore dominant.

7.6 Conclusion

Three system-level phenomena ideexplained by transformative mechanisms, taking the actions and interactions of individuals and use them to understand the emerging phenomena on macro-level. Explanations were given on three system-phenomena identified as being problematic through the use of transformative mechanisms, drawing upon the five social errors as named by Merton. The explanations provide insights in how the system characteristics may have come about. In specific, these mechanisms show how the rational actions aimed at success of a set of individuals may give rise to undesired outcomes on system level.

Conclusions

Social institutions in the horticulture sector

- Important *formal institutions* as regulations, subsidies and contracts influential to investments and innovation seem to support process-aimed investments over marketing investments.
- The GMO subsidy is very influential. The conditions the EU poses have a determining influence on how the grower can cooperate and excludes the possibility of having an own brand and having marketing activities. When rejecting the GMO subsidy, the grower is affected too, as it creates a disadvantage in terms of investment possibilities compared to peers that do make use of the subsidy.
- The regulations by the Dutch government and in specific by the Westland municipality affect innovation practices by stimulating some investments by prescriptions on new requirements on greenhouses (often on physical property or processes). Some other regulations may rather hold back innovations, as in the case of a water-sharing system clashing with regulations that are not (yet) adapted to innovations.
- The Rabobank is deeply rooted in the sector via large investments in horticulture businesses. Although a manager subscribed the problem of over-dominant process innovations, the bank policy only prescribes loans for investments in tangible assets. Also, their policy is solely aimed at individual clients, not addressing the overall impact the bank may have on the sector as a whole.
- The NMA prohibits and punishes ‘economic concentration’. These regulations deprive growers of the possibility to organize a shared strategy to overcome overproduction and market prices dropping under cost price.
- LTO Glaskracht is an organization that employs lobbying activities in the favor of horticulture organizations. As the lobby addresses the wish of the majority of its members, it stimulates the trend of the mass, which may contradict or not explicit include the wishes of innovative growers.

Individual grower stories

- The portrayed growers all had to deal with the same institutional context and sector conditions, but have quite different values, ideals, strategies and believes which makes their innovation practices divergent.
- The stories of de Boer, Scheffers and Looije portray organizations employing strategies to escape the fierce cost-price competition, whereby Looije illustrates how bulk production and marketing can go together.
- The stories of the growers innovating to increase the value of their products show how they had to overcome both formal as well as informal institutions, while the growers active in process-innovation rather benefited by the social institutions as identified in the sector, which may help to explain the dominance of it.

Emerging system phenomena

- Explanations were given on three system-phenomena identified as being problematic through the use of transformative mechanisms, thereby drawing upon the five social errors as named by Merton. The explanations show how the rational actions aimed for success by a set of individuals may give rise to undesired outcomes on system level.
- The process of homogenization in the sector can be explained through isomorphism. Ambiguity in the market and uncertainty amongst growers, stimulates copying behavior. Also, the close cooperation of growers increases the sharing of norms, information, and ideas, defining a norm of professionalism. Moreover, the shared context of social institutions steer organizations to develop the same characteristics.
- For decreasing product values, the explanation seems to lie in a combination of *Immediate interest, Error and self-defeating prophecy*. Economically, the short-term requirements of making enough money to survive has a preferential position compared to long-term needs.
- The explanation on overproduction may lie in the *immediate interest* of growers aiming to increase margins.

part III

Modeling the horticulture system

In the previous part of the thesis, I have presented, discussed and analyzed the outcomes of the ethnographic fieldwork. The bathtub model from Coleman was used as the guiding framework.

The chapters five, six and seven followed three steps of explanation: macro-micro mechanisms giving insights in how institutions affect individuals, micro-micro mechanisms explaining the action-formation process at individual level, and micro-macro mechanisms, explaining the emergence of system level patterns from individual activities.

In this part of my thesis, I will make an attempt to build an agent-based model description, using the rich fieldwork data to build a model making use of the MAIA meta-model.

In this step, I will explore the opportunities and boundaries to the integrated use of the methodologies of ethnographic fieldwork and agent-based modeling.

The structure of this chapter will again correspond with the three steps explanation as in the Bathtub model, and will thereby also correspond with the three previous chapters.

8 Westland horticulture system model description

8.1 Introduction

The previous part provided a detailed description the horticulture sector in the region of the Westland. In this chapter, I will make an attempt to build a model description fit for the MAIA meta-model, based on agents and institutions. The field research and system description are used to make a model description, using the abundance that fieldwork and ethnography produces for a simplified description. The product of this chapter is therefore beside a empirical-grounded model description, an attempt to combine the qualities of proper empirical research known to the field of anthropology with the field of modeling. First, a short model description will be provided in section 8.1, summarizing the previous chapters and presenting a short model narrative.

After, the studied horticulture system is conceptualized into a model in three parts reflecting the three chapters and steps of explanation as framed with the Coleman model. The outcomes of the three analysis chapters will be structured with the concepts as provided by MAIA, into a) the institutional structures, b) the dynamics of the system (decision making and actions) and c) the evaluative structure reflecting the variables the system issues can be studied with. An overview of this is given in section 8.2.

The institutions and system dynamics can be included in the model, by defining them in the structural parts of the model (collective, constitutional and physical structures) in section 8.3, while the system dynamics are defined in the operational structure, in section 8.4. The emerging patterns as described in chapter seven cannot be modeled, as they form expectations of the *outcomes* of the model. These descriptions on transformative mechanisms can however be used in the model evaluation, in section 8.5.

8.2 Model description

The model narrative - as explained in detail in the previous chapters – is built around the innovation practices of horticulture growers in the Westland. Their activities, investments and innovation practices have a strong bias towards process innovations, compared to innovations in products and especially to marketing initiatives. Many identify the strong focus on process innovations as a problem, as the increased efficiency does not only reduce the costs of the horticulture organizations, but also the prices of products on the market decrease as growers are played off against each other by merchandisers. The fierce competition on market prices (and subsequently cost price) of products does not allow the horticulture organization to charge the added value from innovations increasing the sustainability of their organization as efficiency of energy, water and material use and improved labor conditions.

This bias towards process innovation and cost price reduction can partially be explained by long shared traditions and history with an auction system that used to separate growers from the rest of the supply chain. The focus of growers has been on their production and crops for decades or even centuries – till for vegetables the auction hall was shut down. Horticulture practices and social institutions have persisted over many generations, and are in many cases still present - despite the changing environment. It may be these practices, norms, rules and strategies shared by growers and by other organizations in the horticulture sector that create the bias towards process related innovation practices. These shared institutions as well as personal preferences are core elements in the model to explain decision making and innovation practices. Gaining understanding on decision making and the effect of social institutions forms the focus of the model, connecting the individual to macro-level patterns and vice versa.

More specifically, the model is created to get a better understanding of the problem of growers dealing with immediate needs as making enough money, selling their products and minimizing their costs, and on the other hand moving towards other ways of innovation that seem to be the solution to the downward spiral of value decreasing of their products. Many social institutions are in some way stimulating investments in innovations that help to compete on cost price. The model may provide more insights in why some make innovative

decisions, how macro level problems arise from individual action, and perhaps what potential solutions may be for problems in the sector.

8.3 Model conceptualization

In the following sections I translate the findings of the preceding chapters into a model description into the meta- model of MAIA. The MAIA meta-model and software provide a way to conceptualization, design and implement the system description into an agent-based model. As discussed in the theoretical background chapter, this model draws upon the work of Ostrom and Coleman, and is mainly centered around social institution and decision making processes of actors (Figure 12).

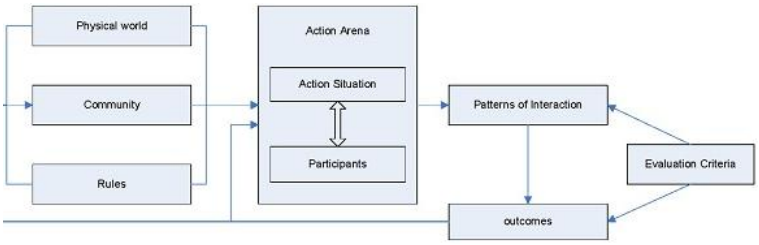


Figure 12 - IAD framework

The left part of the figure addresses the system conditions and structures, defining some prefixed conditions in the system to be able to define the specific system of study. The middle part hosts the action arena, in which choices, activities and thereby system dynamics take place. In the right part, the evaluative structure allows to study the outcomes of the system and its dynamics, as outcomes that can be studied with variables and larger system patterns. The determination of the evaluation criteria defines the analysis of the model, as it is the relation between the pre-fixes settings of the model and its system outcomes that forms the subject of research.

The MAIA model as introduced by Ghorbani is based on this IAD framework of Ostrom, though operational sing it a step further into a meta-model, allowing to model the system of study. The process of creating the model in this research entails the translation of the plural and detailed information from the empirical research into a MAIS model description. This is centered on five 'parts' of the MAIA model:

a) **The collective structure**, involving the description of the actors (or: agents, in modeling language), their properties, personal values, believes (accepted information), physical components they work with, and their decision making criteria.
b) **The physical structure,** in which the physical components of a system are further described in detail, as the characteristics and the 'behavior' or these physical components have.
c) **The constitutional structure** describes social concepts in the system, as the social institutions, the roles that actors can take and the way actors are dependent on each other.
d) In **the operational structure**, the dynamics of the system are described, by connecting the physical, constitutional and collectives structures, defining the action arena's in which the actions take place.
e) The **validation of the model**: the descriptions on the variables that can be studied when exploring the system dynamics, defining the core workings and expected findings of the model

These bodies of conceptualization of the system will be described three distinct subsections, corresponding with the three steps of explanation from the Coleman model, and thereby the three preceding chapters. In the

three sections, the outcomes of the fieldwork and social analysis, as discussed in chapters five, six and seven will be processed towards a model description fitting the MAIA meta-model.

Chapter structure	Coleman's bathtub model	Corresponding chapters:	MAIA blocks
8.3 'system structures'	Macro-micro effect: Situational mechanisms	*Chapter 4*: social institutions (formal and informal) affecting individuals	Collective structure
			Physical structure
			Constitutional structure
8.4 'system dynamics'	Micro-micro processes: action-formation mechanisms	*Chapter 5*: decision making and innovation practices of individual growers	Operational structure
8.5 'emergence'	Micro-macro processes: transformational mechanisms	*Chapter 6:* explanations on the emergence of system level phenomena	Validation

Table 9 - Overview of input and mechanisms used for modeling

From ethnography to modeling

The steps of transforming the ethnographic data into descriptions that fit into the MAIA meta-model are described in each of the three sections. I will first describe the distinct blocks making up the MAIA meta-model in more detail. After, I will discuss what of the ethnographic data will be fed into the meta-model, and will describe why those decisions are made. The dilemmas, solutions and decisions made will be discussed showing some of the process of linking the ethnographic fieldwork to agent-based modeling. Core themes are reduction of complexity, generalization, decision making mechanisms, and the balancing of structure and agency in decision making mechanisms.

Beside the insights gained in the process of creating the model description, the model description itself is another outcome of this chapter. The MAIA coding that forms the input for the actual model is composed of tables and diagrams that accompany the descriptions are added to the sections. Altogether, the three sections show how I transform the outcomes of the fieldwork into the MAIA model, suggesting ways to overcome the differences between the two methodologies.

8.4 System structures: the modeling of social institutions

In this section the system structures – the more enduring entities of social systems – will be defined within the MAIA meta-model. The social institutions as described in chapter five, defined as the "*shared concepts used by humans in repetitive situations organized by rules, norms and strategies*" (Ostrom, 2007), will be translated into MAIA structures.

A core goal of this section is to find out how social institutions identified in the previous part can be modeled, as the research question of this thesis addresses the influence of these institutions on individual innovation practices. The rules and regulations that are embedded in documents and are of formal nature, as contracts, and agreements that often involve punishments as fines. These institutions affect the decision space of individuals: social structures and institutions determine both the restrictions as well as opportunities for individual growers (Giddens, 1984). These implications should be literally defined in the model, as a model on itself does not link institutions, actions and punishments itself. The same holds for social institutions that are of informal nature and do often not involve direct financial punishments, but may engage social punishment. Also the shared strategies need to be defined. As discussed in the methodologies, this will be done using the ADICO syntax that brings guidance to identifying and labeling social institutions into rules, norms and strategies.

As the model will be built from scratch, the definition of social institutions is not enough; the system also entails the actors, the roles they can take and the physical components they work with. Moreover, the relations between these roles, physical components and institutions have to be defined. All of this will be

describe in this section, defining some prefixed aspects of the system being modeled. In the next section, paragraph 8.4 the system dynamics will be defined.

8.4.1 Collective structure

"*An agent is an institution-driven entity in the system who must take roles to be able to perform tasks in a given system*" (Ghorbani, 2012).

The collective structure entails the description of the actors (or: agents, in modeling language), their properties, personal values, believes (accepted information), physical components they work with, and their decision making criteria. In my MAIA model, I distinguish two types of actors, the 'Grower' actor and the 'Public agent' actor. The stories of the individual growers of chapter six will be used to define different types of the agent 'Grower'. The differences occur in the values of the properties of the growers have. This means that all growers have the same properties, but may have different values of those properties. In that way, the different types of growers as the respondents in the fieldwork are described in a simplified way in the model. The public agent can take different roles, which are other organizations in the sector.

The growers are described in more detail, as they are human beings having personal properties, values and background. Also, the research is focuses innovation practices and decision making processes. The public agent features the other organizations in the system that have an effect on the innovation practices of grower via the social institutions they carry. These organizations can be enacted by the public agents by taking on the role of the organization.

Growers

The most important and detailed actors in the model are the growers and their organizations. From the fifteen interviews of growers, five stories were selected showing different organizations and growers baising their decisions on different believes, experiences and values. These five case studies of growers are modeled as five different types of the same agent type named 'Grower', being distinguished solely by their different priorities, physical components and properties. The growers are all different and described individually, but they do have some properties in common.

Growers cultivate their crops in the greenhouses and harvest them once or twice per year, aiming to sustain the organization and making enough profit to live from. For the process of cultivation, several physical components are needed as the greenhouse itself and materials as seedlings, fertilizers, pesticides, and nutrition. Also, some growers decide to use machines that make the process more efficient. This lowers the use of water, energy, material and also labor. Subsequently, the costs of the process are reduced.

property	Property values
age	[16-25, 25-40, 40-60, 60+]
familiy ID	number
grower background	[true, false]
education	[old-tuinbouw, new-tuinbouw, other]
neighbour ID	number
cooperation	[official, tight, loose]
size	[small, medium, large]
focus	[market, proces]
school ID	number
money	[small, medium, large]
successor_guarantee	[true, false]

Table 10 - Properties and values of the 'Grower' agent

When growers have enough capital, they might spend it on an investment. The main goal of all the growers is to sustain the organization by making enough money. However, the way in achieving this depends on factors like the information and preference growers have, combined with the provided possibilities. In the model, the decision making of the grower is based on several factors. The agent's decision making process is modeled according to the Multi Criteria Decision Analysis (MCDA) concept. The decision making structure is not static as the value of factors is influenced by changes in the internal state of the agents and state of the system. The implemented MCDA is a simplified representation of the decision making process based on several factors:

- The properties of the growers
- Their personal preferences
- The believes or 'information' decisions are made on
- The properties they have access to
- The way the decision criteria are balanced

Properties

The properties of growers can have different values, portraying the differences between the actors and their organizations:

- The life stages growers are in can have quite a big impact on his decision-making**. The age** of the grower is therefore a property. While the youngsters attend school and get quite innovative ideas nowadays, they are often still under influence. At the age 20-35 they have new ideas, have control over their organization themselves, and are more likely to make large investments in new technology with a long payback time, as they are in the start of their career. In the age category 35-55 growers also invest a lot, as they are not thinking about stopping, but may not have the newest ideas and ability to adopt new ways of innovation. The group older than 60 has to start thinking about the way they are going to finish their career as a growers, and on whether their organization will be continued or stopped.
- **The FamilyID** links growers to each other as family members. Information, norms and help is shared among family members, which makes the links between these actors of a special type.
- **The background** of the grower has been identified as a property that matters in the way he is able to run an organization. If a grower has a grower background, he inherits knowledge, norms and the location, while those starting of as the first in the family, these growers can fill in the strategies and routines from scratch
- Also, **the education** of the grower, the growers that went to the 'tuinbouwschool' or other greenhouse related education, mainly obtained information on horticulture, and in specific process-related. Youngsters that are now receiving education from tuinbouw programs, get new ideas that are innovative compared to the present knowledge, which allows them to get new ideas and norms, which may lead to innovative behavior and change in the sector. Growers that had a non-tuinbouw education, as sociology and marketing, may have adopted a special view on horticulture, which allows them to develop non-process parts of the organization better then process-specialized growers.
- Growers that have a close proximity are tied to each other by a **neighbor ID**. Their proximity may encourage them to share innovation, copy innovations and share ideas and norms.
- The **types of cooperation** growers are in says something about the social capital they might benefit from. Growers that are involved in an official cooperation, may initiate joint initiatives and investments and make joint decisions. The chance they share information, copy innovations and share ideas and norms is higher. Growers with close (but unofficial) relations and cooperations also share information and norms, but make their decisions themselves.
- **Size** matters when it comes to horticulture practices. The difference between the sizes of the greenhouses is that a larger organization allows a grower to produce on a large scale and divide investment costs between a higher number of products. This means that some growers are able to

invest higher amounts of money, and can thereby buy larger machines, as their volumes and turnover is larger. Medium organizations can still invest. Small greenhouses are <3 ha, medium is 3ha to 15 hectares, and large is 15 and above hectares.

- **The focus** of innovation differs per grower. Some growers rely more heavily on information that comes from outside, while others are more process aimed. Growers with a market focus base their decisions more on external information and are more adaptive to this information. Growers that have a process focus rather take information on their business as an input for decision making
- **The School ID** links growers to each other that have attended the same school and obtained the same information.
- The **amount of money** growers have available to invest in innovations is often tied to the size of their organization, as the turnover is larger in general. In times of crisis, or after making bad decisions, this may be the case to a lesser extent.
- When a grower knows for sure he can transfer his organization to a **successor** (in general, his son or nephew) he will be more willing to invest and modernize his organization. When a grower is uncertain about the future of his organization, or is sure he will not be succeeded, it is less likely he will make large investments with a payback time.

The stories of the five growers are characterized in five distinct grower types, portraying their features in a strong way to make them clear distinct personalities. The five types resemble the case studies as described in chapter four, but are simplified and their behavior is amplified in the model. The five types of growers used are characterized in the table "Property characteristic table of grower agents":

Type:	Inspired by case-study:	Scale:	Consumer contact:	Competition:	Core innovations:	Cooperation:
Niche grower	Fam. De Boer	small	no	Niche market	Product + marketing	Greenery
Large bulk	Ruud de Vries	large	no	Bulk/cost price	Process	Cooperation
Innovative bulk	Jos Looije	large	yes	Bulk niche	Marketing + product	Close colleagues
Moderate bulk	De Jong	medium	no	Bulk/cost price	Process	Cooperation
Shop grower	Fam. Scheffers	small	yes	Differentiation + service	Marketing + product	Collegues

Table 11 - Property characteristics of grower agents

Public actors

Growers are connected to several other actors in the system, affecting their innovation practices via the social institutions they carry. The organizations that will be modeled are:

- ***Bank***: growers can lend money from the bank to make investments and have to pay back their loans with interest. When organizations are in trouble, the bank may take over or liquidate the organization and retrieve loans.
- ***European Union***: growers may apply for an GMO subsidy to cover for 50% of an investment if they are connected to one of the larger sales cooperations and abandon own branding and marketing activities.
- ***Municipality and government***: formulate regulations to improve safety, labor conditions and environmental performance. Monitoring of growers and punishing when
- ***LTO glaskracht***: lobbies for the growers attached to the union to change regulations in their benefit
- ***Merchandisers*** (sales cooperations and supermarkets): The merchandisers can buy products of the producers, and trade them off by refusing crops with higher prices, putting pressure on growers

The model is built around the growers and their innovational activities. However, the growers are affected by other organizations as they interact in the same system. Moreover, the formal social institutions as regulations and contracts are governed by other organizations. The just defined actors were named as being the most important and influential actors on innovation practices during the fieldwork.

8.4.2 Constitutional structure

"The constitutional structure covers the social concepts of a system. The structure defines roles, institutions and role dependencies" (Ghorbani, MAIA website).

In this section, I will define the roles the agents can take, and the social institutions and the way these are tied to each other. This section is an important one, as the

a. Roles of growers

The growers can take different roles with activities that are tied to them. To take part in the society, agents enact *roles*. A role is an "*abstract representation of a set of activities that are performed according to some rules in order to reach social objectives*" (Ghorbani, XX). For some roles, growers can make the decision to become active in that role, for example to become a member of the bank, or to become a GMO subsidy user. When accepting the money, the grower can be hold to the institutions tied to his role as a member of the bank or GMO user. On the contrary, a grower is in my research always the owner of a greenhouse, he cannot choose not to be so, as it defines him as a grower. The institutions tied to 'greenhouse owner' therefor hold for everyone. Examples are the regulations by the government/municipality and the NMA. The growers have capabilities in their roles, as well as institutions that have power over them.

The roles growers can take are:

- **Owner of greenhouse**: as an owner, a grower bares the risk of the greenhouse, aims to make profit with it, and is responsible for his greenhouse, and has to make sure he complies to the regulations
- **Investor**: as an investor, a grower can spend money on new initiatives in his organization, being able to choose between the four categories of strategies: volume increase, cost reduction, product innovation, and marketing innovation.
- **Seller**: a grower can calculate the price of his products, and sell his products to the market and earn money with it. He can also drop his prices when his products are not being bought.
- **Client of bank – normal**: as a client of the bank, a grower must communicate his progress and new plans, and may get more loans from the bank if the bank believes in him.
- **Client of bank - danger zone**: as a client of the bank in a danger zone, a grower must obey the wishes of the bank. He cannot take another loan.
- **GMO user**: when a grower decides to apply for the GMO subsidy, he subsequently becomes a GMO user, having to obey the rules of the European Union.
- **Member of LTO glaskracht**: as a member of LTO glaskracht may indicate a lobby direction
- **Member of a network**: as a member of a network, a grower can participate in joined initiatives, sometimes obeying the wish of others, sometimes having others joining his idea. Also, he can obtain new knowledge and norms via his network.

a. Roles of public agent

The public agent can take five different roles, portraying the organizations that were identified as enacting institutions influential to innovation practices of growers. The organizations are often complex entities with multiple goals and interests. However, for the purpose of this research they are strongly simplified. Only those objectives and institutional capabilities that effect innovation practices in a clear way are defined in the tables that form the input for the MAIA model. These can be seen in attachment 11.4).

b. Institutional statements:

The social system in the Westland contains many social institutions, both formal as well as informal. The formal institutions are called 'rules' and have all ADICO components in them, including a sanction. They are observed by organizations that were describes before. These organizations are modeled as the public agent taking the roles resembling the role those organizations has in the system. They have power over the growers, as they may punish the growers when they violate the prescribed institutions. The institutions are tied to the roles the growers take. This means that the bank punishes the member of the bank, which is one of the roles the grower can take. The institutions carried by the municipality and the NMA hold for all growers, as all growers take the role 'owner of a greenhouse'. Subsequently, all growers can be punished in their role of being the 'owner of a greenhouse'. Through the risk of punishment, the formal institutions often have quite some influence on the decision making of growers, but do not determine them. The growers balance their decisions on formal institutions, as well as on other criteria, as personal values, opportunities and the information they have.

Beside the official institutions, also the informal institutions affect the decision making of growers. These are modeled in two types; social norms and shared strategies:

- The social norms consist of the Attribute (actor), a Deontic (prohibition/permission), and Aim (action) and a Condition: "*Growers (attribute) should (deontic) produce products in line with the quality standard (aim) when they cooperate with other growers (condition)".*
- Strategies are composed of an Attribute (actor), an Aim (action), and a Condition: "*Growers (attribute) buy the neighboring plot (aim) when it becomes available (condition)*".

The identified institutions are grouped in three tables that can be found in the appendix, as they are too many to discuss individually:

- Formal institutions; rules
- Informal institutions; norms
- Informal institutions: shared strategies

c. Modeling social institutions

In chapter four, the main social institutions, both formal as informal where identified, in the case of formal institutions in relation to the other organizations. This identification of institutions was realized through the coding and structuring of all the fieldwork material, after which the institutions that where most commonly named and identified as being of large influence could be identified. As the distinction was already made between the formal institutions (the contracts, regulations and official agreements), and the informal institutions (shared among informal relations as in the grower community as among colleagues), the data had been well prepared for the identification of rules, norms and strategies conform the ADICO framework. For the social institutions, a distinction between norms and strategies still has to be made.

To identify the social institutions, I have gone through the transcribed interviews, websites and official documents. After the first selection of probable institutions, (as described in chapter five), the rules, norms and strategies could be defined according to the ADICO structures, as can be seen in the tables on the next page. The attribute, deontic, aim, condition and possible punishment were identified per institution, thereby not only defining the type of institution, but also linking the institution to actors, actions and other institutions as punishments.

For every institution the relevance and necessity for inclusion needed to in considered, as the model quickly grows to untenable sizes and complexity. For example, the norm of listening to the famous local band 'de Kromme Jongens' is a norm shared by many people in the community, including the growers. Knowing the music of the Kromme Jongens was named as one of the characteristics of being a local, and may be one of the

factors making a person an insider or outsider of a group. This is of importance for relationships, but is very hard to tie to innovation practices directly. This norm was therefore excluded in the model, as it cannot be tied to decisions and activities directly. Some other norms, as the norm that a grower *should be successful* and *make profit* may have a stronger impact on a grower, influencing his investment decisions. This was therefore indeed included in the model.

In the following pages, the three tables of social institutions, being the formal institutions (the rules) in Table 13, and the informal institutions, being the norms in Table 12 and the strategies in Table 14.

Informal	#	A	D	I	C	O
	1	Growers	should	produce cproducts in line of all the quality and safety standards		A
				produce the maximum Kg per m2 as much as they can		
				reduce their cost price per Kg as much as they can to levels of competitors		B
	A	merchanisers	may	refuse to purchase the products of the grower		
	2	Growers	should not	go bankrupt/not make it in the business		C
				sell their products for too low prices close or under cost price		C
	C	(other) Growers	may	refuse to cooperate with the grower anyore		
	3	EU	should not	give out the GMO subisidy, as it ruins the sector	ever	
	3	Rabobank	should not	increase the interest on loans	when growers are a less optimal financial situation	
			should not	keep organizations alive artificially	when they are close to bankruptcy while carrying large loans by the bank	
	4	Grower	may	internalize information provided by the school		
			may	internalize norms provided by the school		

Table 12 - Institutional table: informal institutions (norms)

Formal	#	A	D	I	C	O
GMO subsidy						
	G.1.a	GMO user	may	get a subisidy from the EU for max 50% of an investment	if they invest in an accepted innovation and follow the rules G.2	
	G.1.b	EU	may	give out GMO subsidy of 50% of investment to grc	if they invest in an accepted innovation and follow the rules G.2	
	G.2.a	GMO user	must	join one of the 6 sales cooperations	if they want to get the GMO subsidy from the EU	G3
	G.2.b	GMO user	must	invest in an innovation of which 50% can be civered by the subsidy	if they want to get the GMO subsidy from the EU	G3
	G.2.c	GMO user	may not	invest the subsidy in marketing innovation for their own products	if they want to get the GMO subsidy from the EU	G3
	G.3a	EU	may	refuse to giveout subsidy	if growers don't follow the ruls attached to the subsidy	
	G.3.b	EU	may	fine the greenhouse owner	if growers don't follow the ruls attached to the subsidy	
	G.3.c	EU	may	witdraw the subsidy from the greenhouse owner	if growers don't follow the ruls attached to the subsidy	
Banking						
	B.1.a	Client of a bank	must	write a good investment plan that shows how an investment will be repaid	if they want to borrow money from the bank	B.2
	B.1.b	Client of a bank	must	invest in their organization	if they want to borrow money from the bank	B.2
	B.1.c	Client of a bank	must	listen to bank for instructions	if their money level is 20% of initial level	B.3
	B.2.a	The bank	may	refuse a grower a loan	if his investment plan is not optimal	
	B.2.b	The bank	may	refuse a grower a loan	invest the loan in marketing innovation for their own products	
	B.2.c	The bank	may	increase the interest of the loan	if their money level is 20% of initial level	
	B.3	The bank	may	execute the organisation and withdraw money	if the money level = [20% of initial money]	
	B.4	The bank	may	give out a loan for an investment	if the grower complies with all B.1 actions	
Merchandisers						
	M.1.a	Seller	may	calculate product price	if he has produced products	
	M.1.b	Seller	may	offer products to the merchandisers	if they have products	
	M.1.c	Seller	may	sell producst to merchandiser	if merchandiser buys prodcusts	
	M.2.	Seller	must	drop their prices to competitive prices compared to other grower's prices	if the merchandisers refuse to buy AND grower has proces focus	M.3
	M.3.a	Merchaniders	may	refuse to buy products from seller and buy their products from a cheaper competitor	if the selling prices are above market-conform of other bulk	
	M.3.b	Merchaniders	may	refuse to buy products from seller and buy their products from a cheaper competitor	if the prices are above market market conform of niche products and added value is lower	
	M.4	Merchaniders	may	buy the products from the seller	if the price and quality are conform the market	
School	Sc.1	Growers	may	adopt new norms on horticulture business	if (education = new tuinbouw OR other)	
	Sc.2	Growers	may	adopt new knowledge on horticulture business	if (education = new tuinbouw OR other)	
LTO Glaskracht						
	L1.a	Member of LTO	may	give their opinion on regulations etc	if they are a member	
		LTO	may	lobby against regulations	if the mass of the members do not like	
Municipality						
	R.1	The Owner of the greenhouse	must	obey the regulations that are observed by the municipality by investing in presribed innovations	always	B2
	R.2a	the Municipality	may	wite a letter of notice to the grower to state the violation	if the grower responses pro-active/indifferent and violation is not so bad	
	R.2b	the Municipality	may	warn the grower	if the grower is indifferent/structurally violating and the violation is more significant	
	R.2c	the Municipality	may	fine the grower	if the grower is indifferent/structurally violating and the violation is more significant	
	R.2d	the Municipality	may	take juridical steps in cooperation with Bibob	if the violation is severe/irreversible and the grower is consiously and structurally	

Table 13 - Institutional table: formal institutions (rules)

Shared strategies	#	A	D	I	C
General	S.1	investor		copy the succesful innovations of a collegue	*chance*
	S.2	investor		make own decision on innovation type	*chance*
	S.3	investor		invest in random innovation	*chance*
	S.4	investor		join in on innovation of other grower	*chance*
	S.5	owner of greenhouse		plant new crops	every new year
	S.6a	owner of greenhouse		buy water	every new year
	S.6b	owner of greenhouse		buy nutrients	every new year
	S.6c	owner of greenhouse		buy energy	every new year
	S.7	owner of greenhouse		harvest crops	every new year
	S.8	member of network		start cooperation with other grower	every new year
	S.9	owner of greenhouse		make joint decision to rise prices alltogether	if NMA stops
	S.11	investor		apply for GMO subsidy	when available and in the position to do so
	S.12	investor		increase their scale	when the neigbouring plot of land becomes available for sale
	S.13	Investor		increase their scale	when a new son enters the organization

Table 14 - Institutional table: strategies

8.4.3 Physical structure

"*The physical structure consists of any type of entity that has a physical representation in the system*" (Ghorbani, 2012).

The physical entities also have to be defined. These elements are important, as the processes happening in the system involve greenhouses, crops, capital, water, nutrients, material, etc. It makes the system that is dominantly defined in social terms connected to physical components and flows, just like in the real horticulture sector. The effects of decisions and activities can also be measured by these variables, which will be discussed in the 8.5, the evaluative structure.

Again, the physical components to be included needed to be considered, as there are many types of crops, technologies, innovations, and material streams, etc. which all would have to be described and connected to actors, actions, and situations. To avoid such complexity, I have made some decisions to be able to narrow down the number of physical components without having to take out crucial elements. In the table on the next page I made an overview of some issues and solutions to it.

Problem:	Solution:	MAIA description:
In the horticulture sector, there are many technologies/innovations. The combinations differ per greenhouse, and are in constant change. There are not only different categories, but also variations of the same components.	The solution lies in the problem definition that was described in chapter two. The research is not on specific technologies, but on innovations having a certain impact on the material streams, volumes, efficiency, activity extending and value increase.	The innovations are categorized (physical or not) in the following five types: - cost-reducing component - volume-increasing component - activity extending component - price-increasing component - law-complying component The important characteristics could be defined per category, not having to describe every new innovation.
The crops in the horticulture sector are numerous; not only in the different types of crops, but also in the variation per crop, as in the tomato. The problem entailed the inclusion of different crops without having to define every new variation in crops.	Defining the crops not bales on their own type/brand, but by the characteristics that are relevant to this research.	Defining one type of crop, but allowing the cost price and added value to change per crop, thereby distinguishing the crops by defining their relevant characteristics for this model.
An element of this research is understanding how the ecological sustainability of the sector may be improved, but the model has been mainly focused on social topics as decision making and social innovation.	Defining the effects of the implementations of the five types of innovations not only in economic way, but also in the way they reduce water, energy and material use.	Including the water, energy and material flows in the model, and connecting these to the production of crops and the new innovations being implemented, thereby adding variables that can be studied in the evaluative structure

Table 15 - Decisions made on difficulties in modeling

Physical components

The growers have physical properties they work with, both enabling as well as constraining them in their activities. A large greenhouse may allow the grower to make large volumes, but may constrain him also by being too capital intensive to restructure for a new crop. The access to the physical components as to the greenhouse and crops are crucial elements of being a grower. The differences in the size and numbers of the properties give attributes to the growers, distinguishing them form each other. The core physical components in the system are:

- *Greenhouse*: all growers have a greenhouse in which they produce crops, ranging from small to medium and large size.
- *Capital*: the growers possess small, medium or large amount to invest in their organization and new innovations
- *Crops*: growers produce crops and sell them for money to the merchandisers, who in their turn sell it further up the supply chain to the supermarkets and consumers.
- *Energy*: all greenhouses need energy for their production and can invest in innovations that make energy use more efficient reducing costs
- *Water*: all greenhouses need water for their production and can invest in innovations that make water use more efficient reducing costs
- *Materials*: all greenhouses need materials like nutrients (and often pesticides and herbicides) for their production and can invest in, increasing efficiency and reducing costs
- *Innovations*: the organizations of growers differ in the way that they have invested in other innovations in the past. This means that they all have different components in their organization, mostly physical component as machines, soils, recycling systems, etcetera. What is interesting for this study, are the types of innovation present in the organization and the effect it has on the costs, value of the crops and amount. Therefore, I define the physical components that were invested in and are

present in the organizations as five types of innovations, having different characteristics as is described in the table.

- cost-reducing component
- volume-increasing component
- activity extending component
- price-increasing component
- law-complying component

An overview of how I categorize the specific innovations into the five categories is shown in table XX.

Innovation type:	Effect on Cost of production	Effect on Innovation costs	Effect on Margins	Effect on product value	Effect on number of products	Effect on Market price
Cost-reduction	Decrease	Increase	Little increase	None	Small increase	None
Volume-increasing	Little increase	Increase	Little increase	None	Increase	None
Value-increasing	Little increase	Small increase	Increase	Increase	None	Increase
Activity-extending	Little increase	Small increase	Increase	Increase	None	Increase
Regulation-conform	Little increase	Increase	Small decrease	None	None	None

Table 16 - Innovation categories and behavior of the physical innovation components

Moreover, to be able to include the access to social capital, I have defined the knowledge growers have, as well as the relations they have as physical components. In that way, I am able to add attributes to these indicators of social capital:

- *Knowledge:* the amount, quality and the level of up-to datedness of the knowledge and capabilities of the growers. This may be increased by going to school, learn from other growers, or can be developed individually by reading books or learn from life situations as in times of crisis.
- *Network ties:* In the interviews, grower explained the value of relationships. Attributes of the network of growers are the number of relationships, the closeness and the types of relationships. Growers with a set of very close relations have the benefit of sharing information and help, while growers acting as a single entity might not have this. The downside of close network ties is that the norms and the copying behavior might be stronger.

The physical components are defined in the table that can be found on the next page.

category	**name**	property	type	behaviour	affordance	
greenhouse	**greenhouse**	size	fenced	aging	can be built	growers
		capital intensity		producing crops		growers and bank
		modernity		consuming energy		growers
		n		consuming water		
		morgage		nutrients		
				lose value		
product	**crop**	type	fenced		can be sold	growers
		value			can be bought	merchandisers
		price				
		type				
		amount				
proces input	**water**	amount	fenced		can be bought	investor
		price			can be used	
		origin				
proces input	**energy**	amount	fenced		can be bought	investor
		price			can be used	
		origin				
proces input	**nutrients**	amount	fenced		can be bought	investor
		price			can be used	
		origin				
investment type	**cost-reducing component**	price	fenced	reduce costs	can be bought	investor
		amount		break down	can be funded with GMO	EU
		ROI		create ROI	can be funded by the bank	bank
		paybacktime		age		
investment type	**volume-increasing component**	price	fenced	increase the volume	can be bought	investor
		amount		break down	can be funded with GMO	EU
		ROI		create ROI	can be funded by the bank	bank
		paybacktime		age		
investment type	**price-increasing component**	price	fenced	increase product value	can be bought	investor
		amount		create ROI		
		ROI				
		paybacktime				
investment type	**activity-extending component**	price	fenced	extend product/service	can be bought	investor
		amount		create ROI		
		ROI				
		paybacktime				
social capital	**knowledge**	amount	public	change preference	can be added	member of network
		quality		give ROI	can be shared	
		up-to-dateness				
		applicability			can be bought	
social capital	**connections**	number	public	lead to cooperations	can be made	member of network
		quality		change preference	can be cut off	
		proximity			can be shared	

Table 17 - Physical components

8.5 System dynamics: modeling of decision making and actions of individuals

a. Operational structure

"The operational structure makes use of the concepts in the physical, constitutional and collective structures to provide the dynamics to the agent-based model" (Ghorbani, MAIA website). The operational structure describes the conditions in which agents use their capabilities to act and react, and the changes in the status of the system (Ghorbani et al., 2012).

Action arena

Without the action arena, nothing would happen in the system. It is in this section of the model that the actions of actors are described and placed into order. Ghorbani defines these actions as "an operationalized description of the capabilities of roles or the behaviors of agents and physical components specifying the pre and post conditions for a capability/behavior to trigger, the role, agent or physical component that will be performing that action and the institutions that are involved (if any)' (Ghorbani et al., 2012). The action arena is composed of the action situations describing the arenas of action, and the role enactments that clarify how actors, their roles and activities are connected. A table containing the latter can be found in appendix 13.4, and is named the 'Action-formation table'.

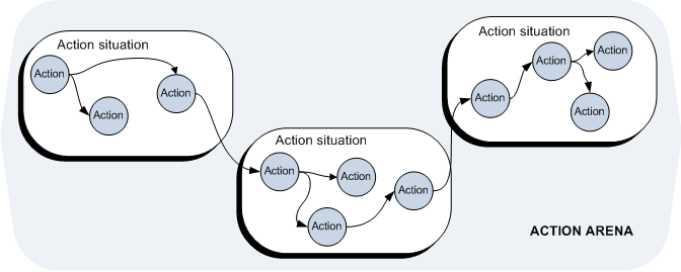
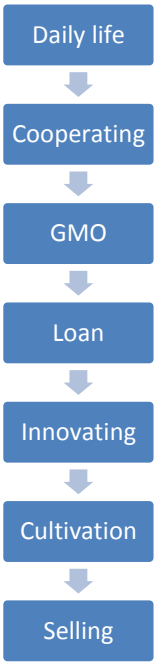


Figure 13 - Action arena and action situations

Action situations:



"*The action situation component defines the overall operational procedure of the system. Each action situation is the placeholder for a set of related actions*" (Ghorbani, MAIA website).

Seven action situations are defined, hosting the activities that had been indicated before in the institutions, physical elements, etc. These action situations are created to define the sequence between activities and processes, and also internally host a sequence of activities. This is important, to create realistic behavior.

Daily life: Within this action arena, the intrinsic capabilities of actors take place, as being born, die, get a child, learn and start relationships

Cooperating: Within the action arena of cooperating, growers can group together and make a joint decision on investments in innovations. Also, knowledge, norms and values are shared amongst growers that are cooperating together, adding up to the social capital of the growers.

GMO: In this action situation, GMO subsidy is requested and refused or given out. Also, growers can be punished based on their previous actions.

Loan: In this action situation, the grower can apply for a loan and receive it or not. Also, he has to pay back his loan and report his money level to the bank, who may take over when the organization is trouble.

Innovating: In the innovation arena, the decisions are made by the growers to invest in one of the categories of innovations. They invest their money in that innovation, adopting a new physical component in their greenhouse with the specific characteristics.

Cultivation: Within the 'cultivation action arena', all horticulture-related activities are performed as cultivation, employing technologies, and increasing efficiency. The investments of former round in innovations affect the cultivation process and produce outcomes, in terms of products, efficiency, use of inputs, etcetera. Also, the money level is checked and reported to the bank (if grower is a member).

Selling: Within the selling action arena, growers calculate the costs and value of their products and come up with a market price. They put their products for sale for a price, and merchandisers buy or refuse their products. Products are exchanged with money. In this action arena growers can sell, get stuck with products, drop their prices and get traded off against each other.

Action situation 'daily life'

Some of the actions of growers are not tied to roles, but come naturally to the actors, as they are human beings. These 'actions' are not tied to specific action arenas but happen in daily lives. These natural actions are called 'intrinsic capabilities', defined as "The capabilities an agent has independent of the role he is taking". Examples of these are being born, dying, getting children, learn at school and start relations with other growers:

Action Situation	Roles	type:	Components/actions
daily_life	owner of greenhouse	**atomic**	adopt new norms and knowledge on horticulture business
			internalize norms provided by the school
			be born
			die
			get a baby
			start relation with other grower

Table 18 - Action situation 'daily life'

Action situation 'cooperating'

The close cooperation and existence of many official cooperations affect the innovation practices of the horticulture growers a lot. The relationships in close networks can be seen as social capital, as they provide benefits as the possibility to do joint investments, obtain knowledge, and get help. Growers can decide to work together or not to do so, and can continue their cooperation or stop after one time.

Action Situation	Roles	type:	Components/actions
Cooperating	member of network	alternative	start cooperation with (random grower via familyID, school ID, neighbour ID)
	investor		refuse to cooperate other
		alternative	invest in joint innovation
			share information
			lend out money
			receive money
		alternative	stop cooperation
			continue cooperation

Table 19 - Action situation 'cooperating'

Action situation 'GMO'

All growers can apply for the GMO subsidy, which is defined as a shared strategy. Growers need to invest and join a sales cooperation first to be allowed to take the subsidy. The EU can subsequently decide to give the subsidy or not do so. If the EU does so, the grower receives the money. Afterwards, a grower can be punished

if he has violated the rules the EU ties to the subsidy. Subsequently, the EU can punish with two alternatives; fine the grower or withdraw the money, subtracting the money from the money level of the grower.

Action Situation	Roles	type:	Components/actions
GMO	Member of network		
	GMO user	atomic	join sales cooperation
	EU		invest in an innovation of which 50% can be civered by the subsidy
			apply for GMO subsidy
		alternative	give out GMO subsidy of 50% of investment to grower
			refuse to giveout subsidy
			get a subisidy from the EU for max 50% of an investment
		alternative	fine the greenhouse owner
			witdraw the subsidy from the greenhouse owner

Table 20 - Action situation 'GMO'

Action situation 'Loan'

Growers can apply for a loan by writing a good investment plan. Based on the money level of the grower, and the type of investment the grower wrote a proposal for, the bank can give out the loan or refuse to do so. If the grower does receive the money he gets it on his bank account. If a grower has a loan, he has to pay back the loan. Also, he has to report the money level to the bank. In case his money level is low, the bank has a set of actions he takes, as increasing the interest, investing to keep the organization alive, and withdraw all his loans (execute organization). In the latter case, the organization goes bankrupt and disappears.

Action Situation	Roles	type:	Components/actions
Bank	owner of greenhouse		
	investor	atomic	write a good investment plan that shows how an investment will be repaid
	bank		
		alternative	give out a loan to the investor (grower)
			refuse a grower a loan
		sequence	pay back loan
			report money level to bank
			listen to bank for instructions
			increase the interest on loans whe organization is in trouble
			execute the organisation and withdraw money
			keep organizations alive artificially by re-investing in them while being in trouble
			go bankrupt/not make it in the business

Table 21 - Action situation 'Loan'

Action arena 'investing'

Innovation picking

The decision making of growers is a central part of the modeling. However, the way innovation categories are picked is not only by the personal decision-making of the individual grower. Also, he can join in with an innovation of a grower he is cooperating with, or copy an innovation of someone in his network after he saw it being a success. Also, a grower can choose and innovation randomly, to include the exceptions.

Way of innovation is chosen:	**chance**
Copy innovation of (random: grower with same familyID OR neighborID OR schoolID)	0,4
Make individual decision on innovation	0,4
Join in cooperation with other grower (cooperationID)	0,1
Random innovation type	0,1

Table 22 - decision routes

In the case of the individual decision making, the grower will make a balanced decision, based on the social institutions, personal preferences, and opportunities. This decision making process will be described in the section 'decision making on innovation'.

Innovation practices

The growers can make investments that can be categorized into strategies to make higher margins and profits, categorized in four types (I to IV):

I. Reducing the costs in the organization
II. Increasing the volume of the production
III. Extending the activities of the organization
IV. Adding value to the products
V. Living up to regulations

An extra category (V) of investment are obligatory investments prescribed by regulations, which *may* help the grower to increase profits, but may also primarily serve to goal of complying with the law. Strategies I and II are common strategies in the sector for increasing margins and profits. These strategies match in general well with the social institutions in the sector. Strategy V is also common in the sector, as regulations on safety, labor conditions and environmental protection prescribe aspects of horticulture organizations, enforcing growers to invest in their organization. In these cases, growers have to invest in those technologies or other adaptation of their organization, regardless of their preferences and information.

Action Situation	Roles	type:	Components/actions	Condition
Innovating	investor	alternative:	copy the succesful innovations of a collegue	chance: 0,4
			make own decision on innovation type	chance: 0,4
			invest in random innobvation	chance: 0,1
			join in on innovation of other grower	chance: 0,1
		alternative:	Invest in a volume increasing component	
			Invest in an activity-increasing component	
			Invest in a value-increasing component	
			Invest in cost-reducing component	
			Invest in a oblidged component	

Table 23 - Action arena 'investing'

Action arena 'growing'

In the 'growing action arena', the actual horticulture process is taking place in which materials are consumers, being water, nutrients and energy. From there, two lines of action continue:

- After planting the new crops and adding the input, the products can be harvested and added into the niche and bulk stock.
- After the input for the process is bought, the rent and loans have to be paid, and also fines coming from punishments if they are there. In this action arena, the grower checks his bank account to see how well he is doing, and to report it to the bank.

Action Situation	Roles	type:	Components/actions
Growing	owner of greenhouse		
		sequence	plant new crops
			buy water
			buy nutrients
			buy energy
			harvest crops to stock
		atomic	produce products in line of all the quality and safety standards
		alternate	reduce costs
			increase the volume
			increase product value
			extend product/service
		alternate	create ROI
			break down
		alternate	age
			break down
		sequence	consuming energy
			consuming nutrients
			consuming water

Table 24 - Action arena 'growing'

Action arena 'selling'

One of the issues in the sector is the spiral of decreasing product value, leaving the growers with the same minimal margins, despite of their cost reduction efforts. This market price dropping is not just the effect of cost-price reduction which allows growers to sell their products for lower prices (as this increases the margins between the market price and cost price). The dropping of market prices can be assigned to the buying behavior of merchandisers, buying the cheapest available, trading off growers against each other. So in the case of growers applying the cost-reduction and volume-increase innovations, first, growers maintain the same market price while lowering their costs, earning more money. However, as the pressure of selling is high and merchandisers buy the cheapest, growers will go down with their cost-prices if they don't sell their products: *sell → not sold? → lower price → sell* (this is a loop).

In the case of the growers that invest in value-increasing and activity-extending innovations, the lowest available cost price is not the only factor in the decision making of the merchandiser. As the grower adds value and may make his product unique in the sector, the competition will look different. For these growers:

- the product is more unique in the sector, which brings down the competitions to just some peers or no competition at all

- The product has a higher price, but the value is also higher. This makes the consumer, and therefore the merchandiser accept the higher price.

Action Situation	Roles	type:	Components/actions
Selling	seller		
	P: merchandiser	sequence	calculate product price
			offer products to the merchandisers
		alternative	refuse to buy products from seller and buy their products from a cheaper competitor
			buy the products from the seller
		alternative	sell products to merchandiser
			drop their prices to competitive prices compared to other grower's prices
			make joint decision to rise prices alltogether

Table 25 - Action arena 'selling'

b. Decision making on innovation

In the former paragraph, the decision making of growers on innovations was described. The way growers can make decisions are defined in four ways: a) Copy an innovation of (random: grower with same familyID OR neighborID OR schoolID), b) Make individual decision on innovation, b) Join in cooperation with other grower (cooperationID), d) Random innovation type. In the cases of a and c, the decision is based on an external event, by copying of joining into an innovation of another grower. Option d randomizes the decision, to cover for the exceptions. Option b is the actual decision making of the growers based on his values, norms, institutions, etc. as studied in the fieldwork.

As the available regulations, norms, strategies and personal values are so comprehensive, it is very hard to include all these factors in the decision making description of growers. After all, the decision for a specific type of innovation may be the result of various sets of decision criteria, not just one combination. In the diagram, the decision is divided in four steps that are further explained in the tables.

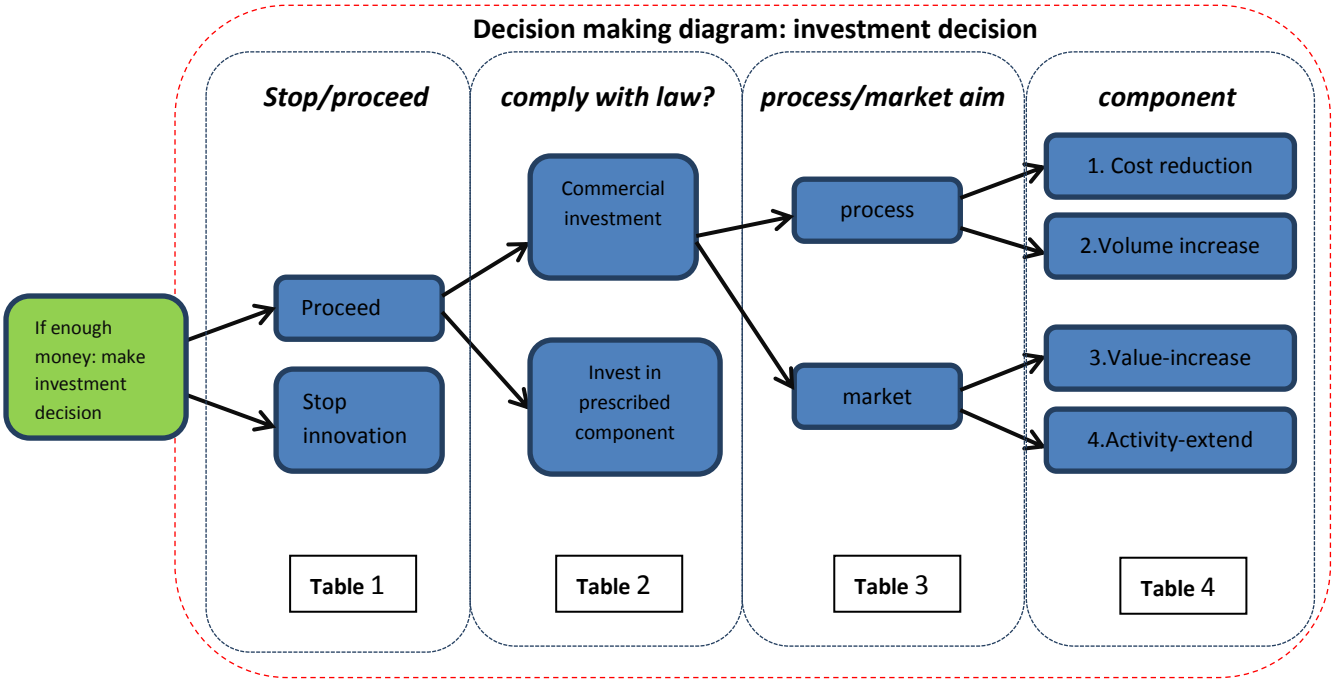


Table 26 - Decision making process

Decision making process

The grower has to make a decision on the five investment types to spend money on. The fieldwork provided quite some criteria that could influence the decision, as the properties, physical components and values. To make the decision process easier to understand, I have divided the decision up in four steps, in which the decision statements are defined in such a way, they cover all possible grower examples. This is important to make sure a grower will always be able to make a decision.

Still, there is an issue of 'rules' and 'exceptions' to solve. A grower may be process aimed, which will as a rule lead to the decision to invest in a component of the process category. However, there may be exceptions, for example in the grower with process focus is young and received new education. To make sure that these exception can happen in the system, these will be defined first. If the exceptions do not apply, the grower automatically chooses for the 'rule', as this one is defines after the exceptions. In table two, three and four, the exceptions are defined in the first table, and the rules in the second table, showing the sequences in which the criteria apply. In the first table, this is not needed. The tables are tied to each other through the action 'continue decision process to table 2/3/4'.

When the grower has enough money, he will try to invest in a new innovation. The decision making process on these investments starts with the first step (stop/proceed). In this step, the grower might decide not to continue, as he is getting old (60<) and may have no successor. Also, the bank may block him in continuing. The second decision step is to invest in a commercial component or in a component that is prescribed. If he decides to invest in a commercial innovation, he has to choose whether this innovation will be process aimed or market aimed. In the last decision, the grower has to choose to increase scale or reduce costs if he chose for a process innovation, while a grower that chose for a marketing innovation has to decide whether he wants to invest in a value-increasing component or an activity-extending.

Step 1: stop/proceed?

In the interviews, the growers also discussed their reasons for choosing not to invest in a new innovation. The main reasons for this are the lack of money (also tied to supervision from the bank) and the uncertainty in their organization when they are approaching the end of their career and do not have a certain successor. To be able to include the decision not to innovate, I have added the decision combinations to the model. In the table below, the grower decides to continue or stop based on his age, successor and the control of the bank.

	Decision statement	**decision**	**Action:**
	If(age < 60) AND (successor = true)		
AND	If (bank takes control = false)	Proceed (P)	Continue decision process to table 23
	If(age > 60) AND (successor = false)	Stop (S)	Stop innovation process
OR	If (bank takes control = true)	Stop (S)	
	If (random 100 < 5 = true)	Stop (S)	

Table 27 - Step1: stop/proceed

Other reasons like sickness or other personal reasons not to invest in innovations cannot all be modeled, as it would become too complex. Moreover, the reasons from growers in the interview are so individual-specific, that they cannot be used as a reason by a larger group, which will be done in the model to create a population not just of 5, but of hundreds or even thousands. Therefore, only those general reasons that apply for more growers, and can be identified as general patterns, are included. A random factor is included to account for this, assuming that 5 out of 100 may indeed choose not to innovate because of personal reasons.

Step 2: commercial investment or law compliance?

In the interviews with growers and the municipality, the regulations that prescribe investments in the greenhouses were discussed. Those regulations address the working conditions for employees, the light emissions, water treatment, and safety conditions. The regulations sometimes specifically describe new requirements, thereby determining what investments should be made in the years the rule is being established. This means that some of the investments and perhaps even innovations are prescribed, and not chosen by the grower. These innovations are accounted for in this step.

In the table below, the grower decides to invest in a prescribed innovation or to invest in a commercial innovation. He may decide to ignore the rules of the municipality, if his money level is low, as he is better off with an investment that helps him to increase his margins. This has been confirmed by both the municipality and by growers, for example in the case of water tanks. However, if the grower has enough money, he is likely to invest in the prescribed innovation, not to risk a fine. Moreover, many growers explained that having ones organization well up to date is seen as professional, when it comes to safety and process improvements. Growers may therefore also choose to invest in an innovation that does not directly contribute to the profits, when he has enough capital do afford this.

	Decision statement	**decision**	**Action:**
	If (prescribed innovation = true)		
AND	If (bank account is low (< x))	Commercial (C)	Continue decision process to table 25
	If (prescribed innovation = false)		
AND	If (bank account is very high (> y))	Regulative (R)	Invest in prescribed component
OR	If (bank punished twice before)	Regulative (R)	

Table 28 - Step 2: law compliance (exceptions)

	Decision statement	**decision**	**Action:**
	If (prescribed innovation = false)	Commercial (C)	Continue decision process to table 25
	If (prescribed innovation = true)	Regulative (R)	Invest in prescribed component

Table 29 - Step2: law compliance (the rule)

Step 3: market- or process aimed innovation?

The examples of growers in chapter five illuminated the differences between growers and their strategies. As in the first chapters was discussed, the organizations can be distinguished on their core characteristics, as in Porter's diagram. Based on those distinctions, the growers got a property 'focus' (which can have the variables of market, process or both) which in the rule define what type of investment they prefer. However, their information can get updated, they can grow older or another reason may create an exception. If the grower has a focus for both, he may choose either one of them with an equal chance. This decision will be random in this model.

The decision process is the hardest one to define, as all the values, norms, rules, etc. can be included in these decisions. Again, it is not possible and desirable to consider all possible combinations of factors in this decision process. On the other hand, including too little factors in this step would exclude all the other studied factors in the fieldwork. It's a matter of including those patterns that could be found in the explanations of growers, and excluding the person-specific ones. Some combinations are given below:

	Decision statement	decision	Action:
	If (focus = market) AND (age >60)	Process (P)	Continue decision process in table 27
OR	If (focus = market) AND (bank control = true)	Process (P)	Continue decision process in table 27
OR	If (focus = market) AND (information = cost reduction is only way)	Process (P)	Continue decision process in table 27
random	If (focus = process and market) random M/P	Market (M)	Continue decision process in table 29
		Process (P)	Continue decision process in table 27
	If (focus = process) AND (age= < 40) AND (education = new education)	Market (M)	Continue decision process in table 29
OR	If (focus = process) AND (personal crisis) AND (social capital = >x)	Market (M)	Continue decision process in table 29
OR	If (focus = process) AND (background = non-grower)	Market (M)	Continue decision process in table 29
OR	If (focus = process) AND (personal value = stay small) OR (be with family)	Market (M)	Continue decision process in table 29

Table 30 - Step 3: market of process? (exceptions)

	Decision statement	decision	Action:
	If (focus = market)	Market (M)	Continue decision process in table 29
	If (focus = process)	Process (P)	Continue decision process in table27

Table 31 - Step 3: market of process? (the rule)

To ensure that the growers will always make a decision, the second table includes two mutually exclusive criteria. These are the patterns. However, different sets of combinations may still lead to the other decision: The organization the grower is active in, may have a processed-aimed character. However, the grower just entered the organization as a youngster, just having enjoyed new education that has quite a new perspective compared to the older programs. He might want to try out something new and apply some of the material he was thought at school, and choose to invest in market-aimed innovation.

Step 4: component choice:

When the grower has made his decision to invest in market aimed innovation or a process aimed innovation, he still has to decide which of the two components to invest in. Some years, growers have to lower their market prices, decreasing their margins. Reduction of the cost price is a useful strategy to increase the margins again. When a grower did not have to lower his market prices and made a good profit, volume increase (as in scale enlargement) may be interesting. In the rule, the grower agent in the model bases his decision on the fact that he had to (or didn't have to) decrease his market price. Some exceptions are possible, if case a son enters the greenhouse or a neighbor goes bankrupt.

Process innovators:

	Decisionon statement	decision	Action:
	If (action 'decrease price' = true) AND (neighboring greenhouse available = true)	Volume increase	Invest in volume increasing component
OR	If (action 'decrease price' = true) AND (son enters organization = true)	Volume increase	Invest in volume increasing component
or	If (action 'decrease price' = true) AND (money level = high)	Volume increase	Invest in volume increasing component

Table 33 - Step 4: Component choice (process, exception)

	Decisionon statement	decision	Action:
	If (action 'decrease price' = true)	Cost reduction	Invest in cost-reducing component
	If (action decrease price' = false)	Volume increase	Invest in volume increasing component

Table 32 - Step 4: Component choice (process the rule)

Market innovation

For the agents that are investing in market innovations, they invest in value increasing components when they had to lower their prices before, as the willingness to pay went down. If they did sell their products, they are able to invest in activity-extending components, as new packaging, transport, recipes, etc.

	Decision on statement	decision	Action:
	If (action 'decrease price' = true)	Increase value	Invest in value increasing component
	If (action decrease price' = false)	Extend activity	Invest in activity extending component

Table 34 - Step 4: component choice (market)

System set-up

The growers have been described with some detail as individuals. In the model, not just five growers will be created, but per type of grower many actors will be made. To make it more realistic, these actor will vary a bit, but not in everything – as they would lose the specifics of their character. The percentages are estimates based on interviews, but can be changed in the model.

Of the shop grower, just 5% will be created:

Name	Properties	Values	Physical components
Shop-grower	age	random age	small greenhouse
	familiy ID	random number (500)	small shop
	grower background	random true/false	
	education	random	
	neighbour ID	random number (200)	
	cooperation	informal	
	size	small	
	focus	market	
	school ID	random number (100)	
	money	small	
	successor_guarantee	random	

Table 35 - shop grower population

Of the niche grower, 20% will be created:

Name	Properties	Values	Physical components
Niche-grower	age	random age	small greenhouse
	familiy ID	random number (500)	
	grower background	random true/false	
	education	random	
	neighbour ID	random number (200)	
	cooperation	official	
	size	small	
	focus	market	
	school ID	random number (100)	
	money	small	
	successor_guarantee	random	

Table 36 - niche grower population

Of the moderate bulk grower, 40% of the population will be created:

Name	Properties	Values	Physical components
Moderate bulk	age	random age	medium greenhouse
	familiy ID	random number (500)	bulk crop
	grower background	random background	
	education	old-tuinbouw	
	neighbour ID	random number (200)	
	cooperation	official	
	size	medium	
	focus	market	
	school ID	random number (100)	
	money	medium	
	successor_guarantee	random	

Table 37 - Moderate bulk population

Of the innovative bulk grower, 10% of the population will be created:

Name	Properties	Values	Physical components
Innovativebulk	age	random age	large greenhouse
	familiy ID	number	foreign greenhouse
	grower background	random background	niche + bulk crop
	education	other	
	neighbour ID	number	
	cooperation	tight	
	size	large	
	focus	market	
	school ID	number	
	money	large	
	successor_guarantee	random	

Table 38 - Innovative bulk population

Of the large bulk grower, 25% of the population will be created:

Name	Properties	Values	Physical components
Largebulk	age	random	Large greenhouse
	familiy ID	number	bulk product
	grower background	true	
	education	old-tuinbouw	
	neighbour ID	number	
	cooperation	official	
	size	large	
	focus	proces	
	school ID	number	
	money	large	
	successor_guarantee	random	

Table 39 - Large bulk population

8.6 Model validation: the emergence of system phenomena

The evaluative structure describes the parameters that are the emergent outcomes of a system. These parameters can be used for model validation (i.e. having built the right model) and also, to answer the questions that the agent-based model should have answers for (Ghorbani, MAIA website). In my case, the evaluative structure will only have the purpose of defining the use of the model and the way the questions can be answered that are central to my research, as the actual modeling is not part of this research.

The bathtub model of Coleman has guided the fieldwork analysis as well as the model description. The first two steps of explanation resulting from the fieldwork (institutions affecting individuals and individuals making decisions) were used as input for the model. The third step of explanation (transformative mechanisms) cannot be used as input of the model, as these explanations are equal to the modeling outcomes, as they both address the system level phenomena emerging from the actions and interactions of individuals. Chapter 7, in which the transformative mechanisms are explained can be used to triangulate the outcomes of the model. The discussed system phenomena also point to variables that can be studied with the model. In this chapter, I will discuss the variables that can be used to measure and study the emergent system elements, studying the patterns of innovation practices that may come to being.

Homogenization

In the sector, some innovation types are much more dominant than others. This is partially due to copying behavior, but also due to the sharing of norms, strategies and information by many. These shared norms in a sector steering companies towards the same characteristics, is called 'isomorphism' as has been explained in more detail in chapter seven.

The question here is how this homogenization can be studied. In this thesis, the homogenization of innovation practices has been studied as the problematic situation. Therefore, the variation in innovation types is the most interesting variable to study, and will be used as the variable at the Y-ax. At the X-ax, multiple variables can be used to plot the Y ax against. First, the variable of time is useful to study the way how. Second, the amount of GMO subsidies given away is interesting to study, as it addresses the question how a social institution (GMO subsidy + contract) influences innovation practices directly. Introducing a switch for some social institutions as the policy of the bank and the norms on copying behavior might be interesting to include to study those effects.

variable:	Y-ax defined as:	calculation:	X1	X2
Homogenization:	variation in innovation types	SUM (number of innovation type 1/2/3/4/5) x5	time	GMO
		incidents of copying	time	GMO

Table 40 - Evaluative structure: homogenization

Product value

One of the current issues in the sector is the decreasing product values. Many products, especially the bulk products are sold with little margins. This means that there is little income flowing back to the grower, which decreases their bank level just a little. With just one innovation not giving good returns, this may put them in danger. Also, this causes more cases of bankruptcy. Graphs can be made with time as the x-value, but also 'number of youngsters', or 'number of innovation types'

variable:	**Y-ax defined as:**	**calculation:**	**X1**	**X2**	**X3**
Product value development:	added value ratio	(added value : product price)	time	# of youngsters	# of innovation types

Table 41 - Evaluative structure: product value

Sector sustainability

Planet

The sector sustainability is in the end interesting to study, and can be divided into the three pillars; people, planet, profit. The planet pillar, studying the ecological impact, can be analyzed through the material use by the growers. One innovation type decreases the costs by saving on water, energy and nutrients. The sustainability of the sector may be studies through the concept of decoupling. The first line of decoupling focuses on how the same amount of products can be made with less input (efficiency). The second line of decoupling studies how the same or more economic wealth can be created with less input materials. So per input (water, energy and nutrients) two graphs can be made, showing both the first decoupling as well as the last decoupling.

Profit

The economic sustainability of the sector is also interesting to study. In my model, I study the economic sustainability in three ways. First, the ratio between companies doing well and companies going bankrupt. Second, the total money spend in the sector on innovations. And third, the total amount of profit being made in the sector.

People

The social sustainability is harder to research. I define three ways to study this. As the greenhouse organizations are closely tied to family income, organizations that are in trouble or go bankrupt put a high pressure on families, and can be said to be socially undesirable. Two graphs can be made with nr. of bankruptcies and the number of companies in trouble, as the grower and their families might have quite some stress when the organization is only just getting around. Also, the social capital available in the sector, in both close ties as well as knowledge can be used to express social sustainability.

variable:	Y-ax defined as:	calculation:	X1	X2	X3
Sector sustainability:					
ecological					
	decrease of unput materials	SUM (water use), SUM (energy use), SUM (nutrient use)	time	GMO	Loans
	decoupling (1)	(SUM (water use) / products)	time		
	decoupling (2)	(SUM (water use) / product value)	time		
		(SUM (energy use) / products)	time		
		(SUM (energy use) / product value)	time		
		(SUM (nutrient use) / products)	time		
		(SUM (nutrient use) / product value)	time		
economical					
	product value increase	SUM (investments)	time	GMO	Loans
	ratio bankrumptcy	(divide (SUM bankruptcy) / (SUM successful ones)	time		
		SUM (money value increase)	time		
social					
	social capital	SUM (added value to social capital)	time	GMO	Loans
	number of bankruptcies	SUM (bankruptcies)	time		
	number of companies in trouble	SUM (companies with money level X)	time		

Table 42 - Evaluative structure: sustainability

Conclusions:

- A model description was made in the MAIA metamodel making use of the information obtained in the fieldwork.
- The three steps of explanation as used in the bathtub model fits the modeling purpose well, as the ‘macro-micro’ step addressing the social institutions could be fed into the constitutional and collective structure, the ‘micro-micro’ step could be used to define the decision making, action and interaction of agents, and the ‘micro-macro’ step provided insights in transformative phenomena in the sector, which could be used to define the evaluative structure of the model.
- Moreover, the combined use of the Coleman model, the IAD framework and MAIA metamodel is useful, as all of them address social institutions and individual decision and action that incorporate social institutions.
- Variety in the population in the model was made by using the characteristics of respondents to portray ‘types’ of growers, using their central trades to create different agents.
- The decision making of agents is based on a multi criteria decision approach, which simplifies the decision making process is based on several factors as: the properties of the growers, their personal preferences, the believes or ‘information’ growers have, the way the decision criteria are balanced, and the properties they have access to.

9 Discussion

9.1 Research subject

The horticulture sector is said to be one of the most innovative sectors in the Netherlands, and frontrunner in the international horticulture scene. At the same time, economic issues as the struggle to sell price-competitive products on the international market have put a pressure on the sector. Experts on the sector, as Marco Hekkert and Leon op de Beek have studied the patterns in innovation activities in cooperation with the InnovatieNetwerk and SIGN, thereby indicating the dominant process focus (cost-reducing strategies) as part of the current economic issues in the sector (Hekkert, 2011, Op de Beek, 2011). Growers lower their prices to stay competitive, approximating the cost-price of their products, making very small or sometimes no profits on their products. At some point, only marginal differences can be made with process innovations, improving the efficiency just slightly, but increasing the capital intensiveness and specialization of the organizations.

Solutions are now looked for in the direction of other *forms* of innovation, as the process innovations are reaching their maximum potential. However, as Hekkert showed, these innovations that would increase the product value (market price) and extend the activities of the organization are practices far less as a strategy in the horticulture sector (Hekkert, 2011). In this thesis, I have taken these patterns in innovation as the subject. While Hekkert has studied the system patterns from an 'innovation system' perspective, in this study, the social institutions are central, studying their effects on individual growers. The hypothesis supporting this study is that the patterns in innovation and economic problems are deeply socially embedded in the sector can be studied with a social perspective, making use of ethnographic fieldwork and social analysis.

To explain the patterns and dynamics in innovation, the matter was studied from the point of view of the growers, addressing individual innovation practices and decision making, thereby addressing the influence of institutions on decisions. This perspective has provided insights on innovation practices at the working of multiple levels. As the individual was taken as the subject of research, the interplay of regulations, norms, personal values, believes and strategies could be studied. This provides both insights on the growers in the sector and the context they are active in, as well on patterns and dynamics of innovation in the system. This perspective on the subject of innovation has provided new insights in the social processes driving innovations, in the patterns and in the dynamics.

9.2 Research questions

In this research, social institutions have formed the focus of analysis, addressing the impact these institutions have on innovation practices of growers. The main question that I will answer is:

How do social institutions affect innovation in the Westland horticulture sector?

With the use of fieldwork, I have built an understanding on how growers shape their innovation practices, and the way they balance their personal preferences and strategies with the social institutions that were indicated as being dominant influences in investment decisions. The research thereby builds further on a theme that has a long history in social science: the relation between the power of institutions and individual decision making, before indicated as the 'structure-agency' debate. In my research, I have approached this duality of the individual and society with the 'bathtub model', as introduced by Coleman. The three steps in the model, explaining how social institutions affect individuals (1), the way individuals make decisions dealing with these institutions, leading to actions (2), and the explanation how the actions of individuals give rise to macro-level patterns (3), have formed three sub questions, guiding the three analysis chapters (chapters five, six and seven). I have subsequently answered the research question in three steps. The first sub-question, central to chapter five is discussed in the next section.

9.2.1 social institutions in the horticulture sector

"Which social institutions are dominant in making innovation decisions?"

The study addressing this question was split up in formal institutions dealing with rules, regulations, contracts observed by other organizations, and informal institutions as norms, strategies and believes shared among growers, forming a more cultural explanation on institutions.

The formal institutions were studied in documents and websites, and discussed in interviews with both experts and growers. The most influential formal institutions were tied to organizations involved in the sector, being the Bank, the Municipality, the NMA, The European Union and Merchandisers buying the products of growers. Some institutions are part of the Dutch regulative system, as the regulations by the municipality (or, government in general), and the NMA and therefore apply to all growers. All greenhouse organization are bound to those rules, reluctant of their choices. In general, it can be said that growers obey the regulations of these institutions, as they are well monitored and punishments can be severe.

The regulations observed by the NMA were indented as having a large impact on the sector and growers individually, as they forbid 'market-concentration' of commercial organizations, meaning that growers cannot discuss on production quantities and market price of their products. This has a two-fold effect: first, growers cannot develop joint mechanisms to improve the market prices of their crops, thereby leaving the market mechanisms as the only mechanism to determine the price, and second; growers are drawn towards the larger cooperations wherein growers have more freedom to cooperate and discuss, as they are not able to do something about the low prices outside these structures.

Some other formal institutions are embedded in contracts growers sign, as when they apply for GMO subsidy at the European Union, and when they apply for a loan at the bank. In these cases, only the growers that apply for these finances are tied to regulations. As most growers need this money in their often large-scale and capital intensive organizations, many growers are tied to those regulations. At the bank, the loans can only be invested in physical components, which are often greenhouses, machines and cars, as they provide security for the bank. What is interesting here is that a manager from the local bank subscribed the issue of the process-aimed investment practices, but at the same time, admitted that the bank only gives out loans for machines and not for price-increasing activities, which are indicated as solutions by themselves. This policy seems contradictory, and may provide a direction for further research.

Furthermore, it would be interesting to study the impact the bank has in the sector overall, as their strategies are defined per client, and are not evaluated over the sector as a whole. This might also be the reason why many respondents criticized the strategy of the bank of 'keeping organizations alive that contain large sums of money of the bank' thereby 'keeping organizations alive in an unnatural way', contributing to the overproduction problem in the sector. Likewise, the European Union is criticized by many respondents on their far-reaching influence on both innovation practices as well as on sectorial structures. The most important rules tied to the attractive subsidy that covers for 50% of (prescribed) investments, are the prescribed connection to one of the large sales cooperations and abandoning individual marketing practices. As the subsidy can make a big difference in the financial possibilities of an organization, many make use of it, thereby accepting the conditions. Since several years, the EU has become stricter with controls, increasing the effect of the institutions, as many growers do not want to risk a fine anymore.

The way the supply chain is arranged in the horticulture sector, with several large supermarkets and sales organizations, and many small producers, is typical for agricultural markets. The combination of the market structure and the characteristics of the perishable bulk products allow 'the perfect market mechanism', and make it possible for merchandisers to choose the cheapest products from the producers that compete with one another fiercely. As the products are perishable, overproduction can occur as the products have an

expiring date before they have to be sold. Due to overproduction and time pressure due to the perishability of products, the power lies at the supermarkets and merchandisers, as they can easily switch between producers. As growers are eager to sell their products, as the continuation of their organization is dependent on it, they are often traded off against each other. The institution that could be identified is that the merchandisers have the rule they buy the cheapest products, and if a grower violates this rule by asking more for his products, he will be 'punished' as the merchandisers can easily buy the bulk products from the competitor. This economic mechanism has a very strong effect of the sector, as it forces the organizations to bring down their cost price to still be able to make money.

The informal social institutions also appear to have a large effect in horticulture sector, as the growers share a long history of practices, shared norms and cooperate with each other intensively – thereby reconfirming norms and sharing information and practices. The 'social capital', which means the value social networks carry as collective and sometimes even economic benefits can be derived from preferential treatment and cooperation between individuals and groups, is strongly present in the sector. This is both described as very important, as grower help each other to get further, often sharing costs, activities or even innovations. However, the close cooperations, sharing of information, norms and strategies can also withhold individual growers to take on complete new innovation activities, as they are embedded in a network in which the conventional innovation practices are supported by norms, strategies of action and believes. The process of isomorphism, as discussed by Dimaggio and Powell, provide explanations how a growing uniformity amongst organizations may arise from copying behavior in uncertain times, and standardized norms on professionalism. An important norm that effects innovation practices, is the norm of the measurement of success, which is often stated as 'many Kg/m2' 'making €/m2' and 'lowest cost-price/Kg'. These norms can steer the innovation towards practices that contribute to these values, thereby living up to the norms present in the sector.

Informal institutions are also present in the form of shard strategies and routines that are of a more practical nature. Routines, or the set of customary and often mechanically performed procedures or activities can be so far automated by actors that they are not questioned anymore, as the grower Jos Looije described. The story of Jos Looije showed that a business crisis in a complete new context (Spain), together with a personal crisis disrupted the taken for granted norms, strategies and routines, because he had to, to adapt to a new situation. Only then, he was able to really act outside the norms and strategies present in the Westland horticulture sector he had taken for granted before. His story illustrates the social hurdle that need to be overcome to create social innovation.

Concluding on this sub question, the exploration on both formal as well as informal institutions have resulted in the identification of several institutions that exert quite some influence over the decision-making of growers. The described institutions, all seem to support the process-aimed innovation practices to some extent. This may help to explain why other types of innovation are less popular, as the institutions may form regulative and social barriers to employ different types of innovations.

9.2.2 decision making strategies and innovation practices

In chapter six, I have addressed the second research question, using the stories of individual growers as examples to study decisions and innovation practices:

"How are decision made on innovation practices at the individual level?"

Out of the set of 15 interviews with growers, I selected five stories of greenhouse owners that portray the lives, organizations, decisions and innovations of growers and their families. These stories function as examples in which the interplay of factors in the decision-making process of growers could be studied more closely. This does not only provide insights in how the social institutions may affect the decision making process, but it also shows the variety of growers and the way they deal with social institutions. This inside perspective on practices and decisions is central to the field of anthropology.

A strong component in the decision making appeared to be the believes growers have on how one can make money in the horticulture sector. While some growers see the reduction of the cost price as the only way forward, others see prosperity in value-increasing activities. This is partially due the type of product and size of organization the grower functions in; growers from large organizations with bulk products are in general less interested in marketing, while growers cultivating niche products have a larger incentive to invest in marketing innovations. Bulk products are easily replaceable and compete on low prices by nature, which makes effective marketing more difficult. However, the example of Looije shows that it is possible. This shows that the disbelief of many growers that the two are incompatible is already a barrier as such, apart from the actual potential of the combines use.

Besides believes, also the personal values growers have make the difference in these cases. The growers having small greenhouse explained they had the wish to stay small, as they could still be involved in the cultivation process, walk around in work cloths, be flexible to step over to other products, have more time for social aspects, or just the wish not to become a 'factory'. Working with smaller numbers of products and not reaching the same efficiencies, these growers are forced to employ strategies that increase the value of their products, to make a living. Moreover, due to their smaller organizations, the purchase of large technologies as CHP's is for them out of the question. Likewise, the decision to join the development of scale-enlargement and mechanization has implications for those growers. The stringent competition these growers are often involved in, forces them to continuously lower their costs, because 'if one is cheaper than his neighbor, he has more reason for existence'. It seems that the used strategies lead to strategic 'tracks' that demand for further innovation of the same type. As an organization is embedded in market relations and cooperations, the knowledge and capabilities of the grower and employees, and the physical greenhouse, radical changes towards another competitive strategy are difficult to realize.

Two other factors that were named are the age of the grower and the educational background he has. Young growers just entering their father's organization often have ambitious ideas on how to modernize the organization, while older growers may be a bit more reserved, especially when they near their retirement without having a clear successor. The education and background may also make a difference. Most of the older growers went to the Tuinbouwschool - succeeding their father or uncle afterwards. The education was in that time still very much focused on horticulture processes, educating new growers on processes again. The new programs, as those from Inholland, now have a much broader offer: on marketing, food commerce, the Greenport business and retail, etc. The education of also non-process subjects makes the new growers better capable to address the current issues and develop new parts of the organization. In those cases, the grower has more 'baggage' which can help him innovating in unconventional ways.

To conclude, the five stories of growers portray human individuals acting in a network, having believes, capabilities, strengths, weaknesses and values. These descriptions on individual decision making are an important step in analyzing innovation practices in the horticulture sector, as they provide explanations on why growers make their decisions on investments. Moreover, the effects formal institutions have on individuals give insight in how they affect the system as a whole. The institutions and dilemmas tied to them show the decision space of the growers, and their space to innovate in unconventional ways. The analysis of the individual stories illustrates how social institutions may withhold growers to invest in unconventional innovations as marketing innovations. However, some other cases show how socially innovative steps may be taken, and how growers may display socially innovative behavior, overcoming some of the social institutions.

9.2.3 emerging system level phenomena

The sub- question central to chapter 7, addressing emergence of system patterns and dynamics was:

"How can phenomena on system level be explained by interactions on individual level?"

Some of the issues in the sector can be explained by studying the behavior of growers on individual level, that together give rise to phenomena on macro-scale. Some of these issues were studied a bit more in-depth, as the homogenization of growers, the down-spiraling value of crops, and the overproduction. In all three of the issues, potential explanation were provided with the use of transformative mechanisms, clarifying *how* these system phenomena may be caused by choices and activities of growers. The underlying question here is why these activities are continued by growers, while many identify the activities as part of the sectorial problems.

The answers lie partially in the effect of unintended consequences which are the unforeseen consequences of purposive action (Merton, 1936). The effects do not have to be identified as undesirable, although they may seem undesirable in the case study of the Westland. With the issue of decreasing value of crops, the behavior of growers can be explained with the social errors of *Immediate interest,* and *Error and self-defeating prophecy*. It might concern a decision between two evils, whereby the more urgent problem may be solved first; selling the products under the cost price to retrieve at least some of the costs made comes before working on stable prices in the sector. Also, expecting others to drop prices to harmful levels, thereby acting upon those believes creates results as if they did, although this might not have been the case.

The issue of overproduction may be explained with the social errors of *Immediate interest,* and *Error of incorrect analysis.* Again, increasing own production may be of immediate interest, while balancing the production in the sector may be of second importance. A neighboring plot that becomes available or son entering the organization may be a stronger factor in the decision making of the grower, than the issue of overproduction in the sector. A mechanisms that supports this error, is the one active in tragedy of the commons, defined as '*the dilemma arising from the situation in which multiple individuals, acting independently and rationally consulting their own self-interest, will ultimately deplete a shared limited resource, even when it is clear that it is not in anyone's long-term interest for this to happen'.* Although the market is not a common pool, the conflict between individual interest and the interest of the group does apply to the situation of overproduction, therefore providing an explanation on the phenomena of overproduction. The second social error to explain overproduction is the continuation of strategies in a changing environment. Globalization, modernization and the discontinuation of the action system changed the sector, which make previous successful innovation practices not well suited to the environment anymore.

The homogenization of greenhouse organizations was another studied phenomenon. The close cooperation of growers seems to increase the risk of developing resemblance of organizations, or 'isomorphism': the process in which organization become more identical, arising from the institutional constraints imposed by the state and the professions (Dimaggio & Powell, 1983). The efforts to achieve rationality while having to deal with uncertainty may lead to copying of successful others, thereby increasing the homogeneity of structure (institutional isomorphism). Especially in times of crisis, this mechanism may have a large influence. The error of the copying and quick spreading of new innovations is that it may be rational for individual organizations may not be rational if adopted on large scale. *"Yet the very fact that they are normatively sanctioned increases the likelihood of their adoption"* (Dimaggio & Powell, 1983: 148).

The three cases show that the problems on system level can be explained with mechanisms and social errors, explaining the discrepancies of people's actions and their opinions. Moreover, the social errors reveal the way interests relate to each other, the way strategies may become legitimate regardless of their outcome, and that the anticipation on what others might do, affect the activities of growers to a great extent. Again, the importance of studying innovations – although they might be quite technical and taking place in an industrialized setting – with a social framework gives crucial insights in the innovation practices in which

specific innovations are chosen. The lessons that can be obtained from this analysis, is that the problems on system level in the sector, are rooted in actions and interactions of individuals. To understand how undesirable patterns may be created and maintained on system level, the study of individual decision and action provides new insights. The study on social errors may help to indicate solutions, as new policies. An example of this is the potential solution of self-organizing mechanisms to counteract the mechanism of the tragedy of the commons. Now, these cooperations are prohibited by the NMA, but may be useful to improve the situation of the sector.

9.2.4 modeling the horticulture system

The fourth research question, addressed in chapter eight, is;

"What can be learned from feeding the data obtained with ethnography into a MAIA meta-model?"

Modeling of social systems inherently involves the reduction of the richness of these complex systems. The meta-model of MAIA already defines the basic elements that can be modeled; actors, behavior, roles, relations, physical elements, etc. Also, the relations between the elements are reduced to just one or several descriptions. Actors may have money, but there are just a couple of things an actor can do with it, while in reality, the possibilities are manifold. The point is to reduce the richness of the social world to descriptions that can be fed into a model, but do reflect the crucial elements of a system. Exactly there lies the challenge, as Albert Einstein stated: "Everything should be made as simple as possible, but not simpler". The last step of simplification is distilling the crucial characteristics of the horticulture sector to be fed into the model.

While in real systems, innovation takes place in a system with changing actors, reinvention, circular processes, feedback-loops, ambiguous environment, divergent and parallel processes, and the model description is based on well-defined behavior. Although this research aims to include elements that make individual actors more realistic, the model is based on a couple of assumptions that form the foundation of the model. This has a two-folded effect; the step towards modeling forces the social scientist to focus on the most important actors, institutions, decision making and physical components. Only those elements that can actively be included in the dynamics of the system, thereby influencing the outcome of the macro-level patterns should be included. On the other hand, the ethnographic research and analysis that allowed for detailed explanations and nuance cannot be fed into the model, as the model would grow too large to be able to make the connections and understand the dynamics. The issue here lies in that the social scientist still has to link everything in the model. All the personal preferences, physical components, learning, properties and information may have effect on the decision making. If all these five variables would have 10 different values, the total set of possible combinations would be too large to include, as they would all have to be defined and connected to the potential decision outcomes.

The way the ethnographic data was analyzed in the three analysis chapters has been a crucial step in bridging the ethnographic work towards MAIA coding, as the chapters allowed to abundance of the data to be presented, but categorized the data already in terms of the MAIA model:

- In chapter five: the descriptions on important organizations carrying influential institutions are used to define other actors in the system (public roles) and the formal institutions.
- In chapter six: the case studies of the individual growers helped to define the agents, their properties, values, physical components, etcetera. Also, the variety of the agents' decision making process could be studied and fed into the model.
- In chapter seven: The discussion on transformative mechanisms describing large scale patterns that are described as being problematic, form the indicators for the evaluative structure.

The three chapters were based on the three steps of explanation on social action, as in the bathtub model. The choice for this model and the advantages and disadvantages is discussed below.

9.3 The bathtub model

The bathtub model on social action - as introduced by Coleman – formed the overarching interpretation n social action for this thesis, addressing both the level of social institutions as individual action. In this research, the model provided the perspective on macro-micro relations, suggesting a way to study social action in three steps; a) the way institutions exert power on individuals, b) individual decision-making and innovation strategies incorporating these institutions, and c) system patterns emerging from individual (inter)action. The bathtub model proved to be a suitable instrument to guide the social analysis with, as it provided a framework to study the relation between the individual (micro) and social institutions (macro) in clear steps.

As the research is based on 'grounded theory' method, the theories and hypothesis are an outcome of the fieldwork, and were therefore not defined beforehand. The bathtub model provided the structure for explanation, but not yet the specific theories. However, the IAD framework was used to define the system elements that had to be studied a bit further, to ensure that the data of the fieldwork would be sufficient to fill in the 'blocks' of the IAD model. The IAD model is suitable, as the 'building blocks', as described by Ostrom are more specific on how social action can be studied, using institutions, actors, decision, action and physical properties as central elements. These elements had been proven to be suitable for modeling purposes in previous research, and have been useful to construct a MAIA model description, that is also based on IAD framework.

Furthermore, the bathtub model proved to be very suitable to transform the fieldwork findings into a MAIA model description. The bathtub model matches the MAIA metamodel well, as the fieldwork outcomes could be linked to the MAIA concepts. The findings on social institutions in chapter five could be translated to the *system structures* (constitutional, collective and physical structure), the decision making, actions and interactions observed in chapter six formed the input for the *system dynamics* (operational structure), and the transformative mechanisms and system phenomena as studied in chapter seven, guided the description of the *evaluative structure,* indicating which emergent properties may be expected. The evaluative structure defines the expected outcomes and the variables that can be used to study those. This is described in the next section.

9.4 Expectations on the modeling results

The third step of explanation in the bathtub model (transformative mechanisms) could not be used as input of the model itself directly, as these explanations are equal to the modeling outcomes: they both address the system level phenomena emerging from the actions and interactions of individuals. The outcomes of chapter seven, the transformative mechanisms explaining the emergence of system patterns and dynamics, could be very well used to triangulate the system dynamics

I. Downward spiral of product value in bulk products
II. Overproduction in the sector
III. Homogenization

An extra modeling outcome was identified, questioning the sustainability of the sector, including variables indicating the sustainability of people, planet and profit elements:

IV. Sustainability of the sector

In paragraph 8.6, the evaluative structure of the model is described, discussing the variables that may be used to study the expected system phenomena as just described. The social analysis of chapter 7 on emerging system phenomena has been very useful to create the evaluative structure, as it had already defined the variables, mechanisms and system outcomes. The combined use of social analysis on social mechanisms and agent-based modeling is expected to make a strong case, as both methodologies and outcomes can be used to triangulate the study.

9.5 Scientific contribution

9.3.1 Industrial ecology

This research is written as a contribution to the field of Industrial Ecology. As discussed before, much of the research efforts dedicated to Industrial Ecology originated from natural science and engineering background, focused on eliminating physical pressures on natural ecosystems, through water, waste, emissions and material extraction. Academics as Cohen-Rosenthal, Ehrenfeld and Boons have pointed out that the human dimension should be considered, by including the actors connected to these flows, as firms, households, governments, NGO's, and individuals (Korhonen et al, 2004):

"*But actual change toward these future visions and a move toward a more sustainable situation will not happen without understanding and influencing human behavior, and will require shaping the concrete measures that decision-makers, firms, and individual consumers implement in practice*" (Steger, 1996).

Sustainability has proved itself to be an interesting matter in this research, as currently the economic issues in the horticulture sector are identified as the most pressing sustainability issue. The many large-scale greenhouses, hosting mono-crop horticultures, are often pictured as unsustainable forms of food production. The continuous process innovations have however improved the process efficiencies, reducing not only the costs, but also the use of water, energy and materials. The proposition that may be taken from this research, is to obtain a sustainable way of production, all pillars of sustainability should be addressed (people, planet and profit). The greenhouses producing bulk products may be the most efficient greenhouses worldwide, but are often not sustainable organizations as the growers are not able to translate these achievements into their product prices. Stated differently; the innovations leading to improved efficiencies, which reduces the footprint of the products, lead to decreasing market prices of their crops, rather than increasing them.

Likewise, the organizations that are very successful in marketing strategies, investing in innovations increasing their product values may score well on economic prosperity, but may not be as successful in process efficiency. One of the outcomes of this research is the differences in strategies of growers are addressed. Many organizations seem to be focused in either process innovations or in marketing innovation. In terms of sustainability, a healthy organization, but also a healthy sector addresses all three of the sustainability pillars.

9.3.2 Previous research

Hekkert, Berkens and Geels have studied innovation in the Westland horticulture system from a social standpoint (Hekkert et al. 2006). As discussed in the theoretical background, the innovation system framework is dominated by institutions. This study has built further on previous work by including in-depth empirical research on individual growers, studying the decision making process and studying the way individual actions are influence by social institutions. Also, explanations are provided on how system level patterns and development arise from individual activities. Identifying social barriers to unconventional ways of innovation provides relevant insights to the current issues in the sector, as it provides insights in the barriers and stimuli for the different innovation strategies.

10 Conclusions

10.1 Research format

Framework

In this thesis I have studied the effects of social institutions on innovation practices in the Westland horticulture cluster in the Netherlands. I have taken the patterns in innovation as identified by Hekkert and SIGN as the subject, starting my research with the hypothesis that the patterns in innovation and economic problems in the sector can be understood from a social perspective, making use of ethnographic fieldwork and social analysis. The social embedding of horticulture organizations and innovation practices is presumed, making the study on social institutions and their effects on individual growers a valuable contribution to existing work on the sector. The research approach formulated in the first part of this thesis illuminated the way this perspective on the sector issues could be studied. This theoretical and methodological research approach has been a central theme to this thesis, as it explores a way to bridge the different fields of science, crossing some ontological and epistemological boundaries: ethnographic fieldwork is used to gain an understanding of innovation practices; and using these outcomes to build an agent-based model.

The bathtub model on social action - as introduced by Coleman – formed the guiding framework for this thesis, addressing both the level of social institutions as individual action. In this research, the model provided the possibility to study the research question in three steps; a) the way institutions exert power over individuals, b) individual decision-making and innovation strategies incorporating these institutions, and c) system patterns emerging from individual (inter)action. The bathtub model proved to be a suitable instrument to guide the social analysis with, as it provided a framework to study the relation between the individual (micro) and social institutions (macro) in clear steps. Furthermore, it proved to be very suitable framework to bridge the fieldwork findings into a MAIA model description.

Contributions

The just described perspective has provided insights in the innovation practices in the sector, as it addresses the *practice* of innovation, which is studied as purely a social process. Not just the innovations are studied, but the *ways of innovation*, and the way these are tied to the norms, believes and strategies supporting these innovation strategies. The methodology of ethnographic fieldwork was instrumental to the study of individual people, their culture, decision strategies and institutions they are dealing with. This anthropological perspective on innovation practices is special in the sense that it explores the role of meanings, ambiguities and contradictions of innovation in relation to social life, addressing both the dynamics and patterns of society and the underlying logics of social behavior. It involves the interpretation of actions in daily lives, narratives, routines and symbols, understood from an inside perspective through participatory observation and interviewing. The study and analysis on decision-making provided insights in the way different people balance their decisions, incorporating not just the institutions, but also their personal preferences, believes and opportunities. Thereby, also exceptions were studied, taking a closer look at innovative behavior and variation of people – which is important to understand innovation. Indeed, it is the exception on institutions that creates new varieties of action, or: social innovation.

An understanding was created on why some innovation types are so dominant over others, by specifying the potential social barriers in the development of new innovation practices. These insights help to understand the innovation patterns and dynamics in the sector, and in specific, the way institutions as policies and regulations effect individual growers (and subsequently, the sector in total). Some first insights were given on both social barriers for change as well on institutions having unintended effects.

This contribution also holds for the field of Industrial Ecology, as it provides explanations on human decisions and actions, that bring about material flows, energy use and pollution: "*But actual change toward these future visions and a move toward a more sustainable situation will not happen without understanding and influencing human behavior, and will require shaping the concrete measures that decision-makers, firms, and individual consumers implement in practice*" (Steger, 1996).

10.2 Fieldwork outcomes

During the fieldwork, both informal as well as formal institutions could be identified as being influential to innovation practices. Informal institutions as norms and shared strategies could be identified. Also several important organizations were discussed as the bank, the EU, the municipality, LTO Glaskracht, sales organizations, along with the formal institutions that relate them to the horticulture organizations, as contracts, regulations and official agreements. In chapter five, the power of these institutions was discussed, showing that the institutions affect decisions and actions in differing ways. Some institutions hold for all growers, as those exerted by the municipality and NMA. Some others are tied to contracts, as in the case of an application for a loan from the bank or GMO subsidy from the EU. In those cases, the growers had to trade-off two options: a) not applying for finances, but not having to agree to institutions in contracts, or b) applying for finances, but agreeing to institutions stated by the organization. Either of these decisions may have huge impacts, as even the smallest differences between organizations and in prices may distinguish success from failure. The pressure resulting from the fierce competition on cost price intensifies the power these institutions have on them. These findings support a better understanding on the decision space and dilemma's individual growers have, and the implications of the effect the institutions altogether may have. This is instrumental to discussions on policy changes and the stimulation of individual growers to improve the sustainability of their organizations.

The stories of five growers in chapter seven were used to explore the innovation practices of individual growers, gaining insights in decision making processes. The five stories illustrated quite different organizations, growers and strategies. An insight was provided on horticulture organizations from a social and individual perspective, opposing the idea of organizations as purely rational profit maximizing entities. By exploring the decision processes and innovation practices, the organizations and innovation decisions that are often dealt with as 'black boxes' are illuminated a bit more. The ethnographic descriptions portrayed the stories of the people involved in the greenhouses and innovations, dealing with their personal believes, values, incidents, dilemma's and decisions.

In chapter eight, three system-wide patterns were discussed: the process of homogenization of organizations, the occurrence of overproduction, the spiral of decreasing product values of bulk crops. Having studied dominant social institutions and innovation strategies of individuals, an understanding was obtained on the reasons individuals act and display certain behavior. With the use of transformative mechanisms, the system-level phenomena emerging from these individuals' actions and interactions could be explained. The most important conclusions that were made entailed explanations on the way social errors on individual level lead to unintended consequences on macro-level. The actions of individual growers are rational from their perspective, but altogether give rise to system patterns that are undesirable for all. Chapter eight gives explanations on how – through which mechanisms – system phenomena may emerge from individual action and interaction.

In essence, the social analysis on transformative mechanisms carries the same goal as the model would provide: understanding the emergence of system-level phenomena from individual (inter)action. Combining anthropology and social analysis with agent-based modeling would serve a strong case of triangulation, as they study the same subject with different epistemologies and methodologies.

Sustainability

The conclusion that can be made in this research is that to obtain a sustainable way of production, all pillars of sustainability should be addressed (people, planet and profit). The greenhouses producing bulk products may be the most efficient greenhouses worldwide, but the growers are not able to translate these achievements into their product prices. Stated differently; the innovations leading to improved efficiencies reduce the footprint of the products, but also lead to a decrease of market prices of crops, rather than increasing their value. Likewise, the organizations that are very successful in marketing strategies, investing in innovations

increasing their product values may score well on economic prosperity, but may not be as successful in process efficiency. This may be explained as the lack of competence of many growers to develop proper value-increasing activities, but explanations may also be found in the workings of market mechanisms. As a conclusion: to improve the overall sector sustainability, the three pillars of sustainability should be addressed equally for it to be sustainable.

10.3 Reflections

This research is quite extensive, as it addresses innovation practices in quite a large sector, housing a great variety of organizations and individuals. This means that the identification of both formal as informal social institutions influential to innovation practices is of exploratory nature, addressing only those that were named as most important by the respondents (both experts as growers). The fieldwork was set up, based on the use of 'grounded theory'. This means that no predefined variables and theories guided the fieldwork, but that the variables resulted from the ordering and coding of data, after suitable theories are used to explain mechanisms known in human behavior. This open scope in the beginning of the research has the advantage that it reduces the bias and scope of the researcher by pre-assumptions. In explorative research, this is useful, as a better understanding needed to be created on which social institutions are most dominant, and a more precise problem statement needed to be formulated. The outcomes of this research do provide directions for more in-depth research, as the conclusions of this thesis may be used as input for a more defined hypothesis.

The use of ethnographic fieldwork, well-known to the field of anthropology, has proved to be very useful and complimentary to agent-based modeling in multiple ways. First, it has provided abundant data that could be used to build a MAIA model description form. The use of ethnographic data is especially useful in creating more realistic actors. Second, it has provided transformative mechanisms that may be used to explain outcomes of the model. Third, some system phenomena have been discussed, which is useful to describe the model evaluation structure, indicating potential outcomes and variables that can be studied to explore those potential outcomes. A fourth significance of more extensive social research is that the modeler is more aware of the elements that are not included in the model. Concluding, social research on the systems being modeled in MAIA metamodel is essential if one aims to build a realistic model resembling the system being studied.

The usefulness of agent-based modeling for the field of anthropology is less clear, as the modeling steps follow from the research. The combined use of the two methodologies would make a triangulation possible. However, the value of the triangulation may be questioned as the obtained data and understanding from the fieldwork is also used as input for the model. This means that the two methodologies are based on the same primary data and understanding of the researcher. It may nevertheless prove useful when the emergence of system patterns are studied, having two different ways of explaining the same thing; through social mechanisms and through system dynamics that can be studied in the model.

The model

The data from the fieldwork is abundant and obviously way too much to include in the model. The question is whether the reduction of the studied complexity goes that far, that the model is too simplistic to study the objected system and dynamics. In examples as the 'traffic jam' model, the subject of study is very clear and well defined: only behavior directed at breaking and speeding needs to be included. One can be quite sure that no crucial social elements are missed, which makes the model very comprehensible and therefore a reliable simulation of reality. In the case of my research, the decisions of growers to invest in certain types of innovations are much more complex, which makes the comprehensiveness of the model less certain. For every actor, institution, action, value, physical component, the reality needed to be narrowed down to minimal proportions. Although the core institutions and decision criteria may be included, the 'emergence' of system properties in an agent-based model is not easily traceable, as phenomena arise.

As the model was not used to study system dynamics, it hasn't contributed to the main research question. The way social institutions exert power over individuals, and the way individuals make decisions

incorporating those institutions need to be described in the model. This means that the research question was answered before the model description was made. The model may be useful to study the emergence of system level patterns, if completed and used to study system dynamics.

A weakness of this model description is the difficulty to include all the studied - and in the model defined - values, norms, strategies and rules in the decision making process. It is relatively easy to define these institutions in the model, but they will only be actively included when being included in the decision mechanism description. The reason for this difficulty is twofold. First, is very hard to define the way the abundance of potential decision factors into a decision mechanism, especially when having to formulate it into literal sub-codes fitting a model. The second difficulty lies in the step of creating a larger population out of a set of individuals. Understanding the decision process of one person, give insights in his strategy as a result of occurrences in his life, personal values, and the presence of institutions. To create a population, a more general decision model needs to be created. This is a clash between the two scientific fields: where the ethnographic study explained the behavior of a set of individuals, in the model description, general decision strategies needed to be formulated. Particular personal events that made some of the decisions of the interviewees meaningful needed to be taken out, as specific events as sickness of a child cannot be tied to a large part of the population, as it is personal. The question here is whether a realistic population can be created, as the generalizing of decision strategies is needed to create a population, thereby taking the personal events out that proved to be meaningful.

The translation of all the system characteristics into the MAIA metamodel and connecting all entities with each other is a very time consuming work. However, it is important to realize that a very complex agent-based model can be created with no programming efforts that are normally required if the meta-model would not have existed. The amount of information and the complexity of the decision making are very high, which would be very hard to model from scratch. More important, for social scientists who in general do not have the skills to model – let alone create models with this level of complexity – building such a model would not have been possible at all if the MAIA model would not have existed.

10.4 Recommendations

Modeling

The model description provided in this research is a first step of creating a full model. In future research, this model may be taken a step further by finalizing the model, after which it may be used to study the system dynamics. In specific, the comparison of the outcomes of the model and the social analysis on transformative mechanisms explaining system level patterns provides an interesting subject. Further insights could be obtained on the combined use of ethnography and agent-based modeling.

Social institutions

One of the goals of this thesis was to provide a system perspective on innovation practices, gaining an understanding of how individual decisions and actions are the result of both personal believes, values and cooperations; as well as from formal and informal institutions exerting power. While the individual growers are taken as the point of view, much can be learned about social institutions at sector level, and the way these effect innovations. This has the advantage of gaining an understanding of how separate system elements (rules, norms and strategies) have a joined effect on individuals. In this thesis, some insights were obtained on this combined effect of institutions on individuals, and thereby on innovation patterns and dynamics in the system. As the research is explorative, these individual organizations and institutions are only briefly studied, and could be further studied in future research. Moreover, some of the topics could be further studied in specific scientific fields, as the impact of the bank policies on the economics in the sector can be explored in the field of economics. In general, the social institutions identified and studied in this thesis, may be studied more in-depth through empirical research, or by modeling specific system elements.

Specific topics

During this explorative research, I ran into several subjects that may provide interesting directions for further research. Some specific topics are presented below:

- How may the efficiency improvements in bulk-products may be used to increase the value of products, rather than reducing the value, as now is the case in the horticulture sector.
- The influence and desirability of regulations by the NMA which potentially block the development of agreements amongst growers improving the sustainability of the products and sector as a whole.
- The impact the GMO subsidy has on the horticulture sector, and innovation practices in specific.
- The effects important actors (as the Rabobank and LTO Glaskracht) have on the sector, preferably concluding on ways those specific organizations may contribute to the sustainability of the sector.
- The evolution of social institutions would form an interesting subject of study. This could not be included in this thesis due to time restraints.

Attachments

11.1 Interview material

Onderzoek naar sociale innovatie
in de Glastuinbouwsector Westland-Oostland

11.1.1 Sociale kenmerken

Telers onderzoek Naam:	Datum: Plaats:
Gender:	Leeftijd:
Jaren actief in de sector:	Opleiding/achtergrond:
Beschrijving start in het bedrijf:	Aantal voorgaande generaties:
Bedrijfsnaam:	Oprichtingsjaar:

11.1.2 Innovatie categorieën

Type innovaties

- Specialiseren (minder producten)
- Diffusie (meer producten)
- Schaalvergroting
- Schaalverkleining
- Geen innovaties
- Internationalisatie
- Emigratie
- Verandering van product categorie
- Marketing innovatie
- Glas gerelateerd
- Warmte/luchtgerelateerd
- Licht-gerelateerd
- Plant innovatie (bio-tech)
- Substraten en nutriënten innovatie
- Hernieuwbare energie
- Stoppen met het bedrijf

Vragen:

a. Missen er soorten innovaties?

b. Staat innovatie gelijk aan nieuwe technologieën?

c. Zou je de soorten innovaties kunnen categoriseren? Zo ja; hoe?

   a. Welke eigen categorieën?

d. Zou je de soorten innovaties kunnen plaatsen van minst aantrekkelijk tot aantrekkelijk?

e. Kun je uitleggen waarom sommige innovaties aantrekkelijker zijn dan andere?

Innovatief	Huidige innovatie	Verouderde innovatie

Betrouwbaar	Onzeker

Bekend	Onbekend

Interessant in het verleden	Nu interessant	Interessant in de toekomst

Goed uit te voeren	uitvoerbaar	Moeilijk uit te voeren

11.1.3 Innovations in the organization

a. Hoelang bestaat het bedrijf al?

b. Welke innovaties zijn er doorgevoerd door de tijd heen?

c. Zijn de soort innovaties veranderd?

d. Zijn de omstandigheden veranderd om in te innoveren en hoe?

e. Hoe is de manier van innoveren veranderd door de tijd heen?

f. Heb je het gevoel zelf te bepalen over technologieën?

g. Is innovatie veranderd door de tijd/generaties heen?

h. Wat heeft daar het grootste effect op gehad?

Middelen:

- Tijdlijn maken met innovaties
- Veranderingen in de markt aangeven op de tijdlijn

11.1.4 Innovatie keuzestrategieën

Persoonlijk:

1. Wat betekenen innovaties voor jou?
2. Hoe kom je tot een beslissing te innoveren?
    a. Welke informatie is nodig?
    b. Welke handelingen zijn nodig?
    c. Welk contact is nodig?
    d. Welke middelen zijn nodig?
3. Hoe weeg je af in welke categorie je gaat innoveren?
4. Welke redenen zouden je stimuleren te innoveren?
    a. Verschilt dit per type innovatie?
5. Welke redenen zouden je afremmen te innoveren?
    a. Verschilt dit per type innovatie?

Relaties:

1. Met wie overleg je over innovaties?
2. Wie spelen een belangrijke rol in de keuze maken te innoveren?
3. Moet je je aanpassen aan bepaalde mensen of bedrijven?
4. Heb je bepaalde rollen die je moet vervullen?

a. Familie/bedrijfsleider/collega-teler/klant van de bank

Toekomst:

1. Wat zou je willen in de toekomst?
2. Weet je hoe je dat zou kunnen bereiken?
3. Hoe ga je om met onzekerheden en toekomstige onzekerheden?

Externe invloeden:

1. Zijn er veel regels en wetten die jouw keuze voor innovaties beïnvloeden?
2. Zijn afspraken met anderen die jouw keuze voor innovaties beïnvloeden?
3. Heb je het gevoel dat je keuze voor een deel bepaald wordt door meningen in je omgeving?

11.1.5 Sociale mechanismen

Mechanism	Variables	Waar/onwaar
Conscious imitative behavior	Ik kijk naar voorbeelden als ik mijn investeringen doe Ik zou voor een innovatie kunnen kiezen die nog bij niemand te zien is Ik kies alleen voor innovaties die bij anderen succesvol zijn Als anderen de innovatie aangenomen hebben zal deze vast goed zijn	
Isomorphism	Er gelden bepaalde kenmerken aan een bedrijf die haar al dan niet professioneel maken	
	- welke kenmerken heeft een goed en respectable bedrijf? - wat verwachten clienten en andere bedrijven van je? - hoe zorg je dat je aan die verwachtingen voldoet?	
Conformism	Ik kies innovaties uit op hun aangetoonde success De technologieen en innovaties in mijn bedrijf komen veel voor Ik zou niet zo snel compleet nieuwe innovaties aannemen Ik vind het belangrijk dat andere telers over mijn bedrijf vinden	
	- welke mensen of bedrijven hebben een mening over je bedrijf, en welke meningen zijn belangrijk voor je?	
Doing things differently	Ik kies innovaties uit op hun originaliteit Bewezen technologieen zijn interessantere innovaties dan nieuwe Ik heb andere en orginiele innovaties vergeleken met anderen	
	- hoe kom je op ideeen voor nieuwe innovaties? - is het moeilijk iets compleet nieuws te doen?	
Rational actor	- wat is de meest belangrijke factor die bepaald welke innovatie je kiest? - do you feel like you can make the right decisions for your company? - how much certainty do you want when investing in a new technology?	
	Kostprijs is de belangrijkste factor in mijn keuze voor innovaties Mijn keuzes zijn niet geheel economisch bepaald	
Interpretivism	- what influences play a role in choosing an innovation to invest in? - what types of innovations are there? - how do you categorize them? - how do you value them? - what is the best reason to innovate? - what is the best way to choose for an innovation?	

Urge to innovate	- ik zou mijn bedrijf graag behouden zoals zij is - ik vind het belangrijk mijn bedrijf continu te innoveren	
Resistance to change	- how do you feel about the continuous supply of new innovations? - vind je het leuk om te innoveren? - vind je alle innovaties interessant? Which not and why? - vind je het jammer dat de glastuinbouwsector veranderd? - Zou je je huidige strategieen en bedrijf willen behouden? - do you think strategies and routines build up in time are the basis for future success? - do you see changing your routines as positive or negative?	
Insecurity and regression Vs Revolution in harsh times	- do you feel the urge to fall back on old strategies and routines in times of uncertainty? - do you prefer not to try out new things in times of uncertainty? - is there room for innovation in harsh times? - only in times of financial prosperity, there is room for new innovations. - especially in times of crisis, I should be ready for radical change.	
Systematic and cultural coherence	- do you feel like your should live up to certain expectations amongst peers? - do you feel you have to live up to expectations of the community? - what role does the Westland culture play in your company?	
Rejection of outsiders Vs. Believe in outside help	-De innovaties van tegenwoordig worden opgedrongen door andere partijen -De innovaties die door anderen aangedragen worden passen vaak niet goed in de context van onze bedrijven -Het Westland heeft de innovaties nodig die door anderen ontwikkeld worden -Telers die geen ervaring in de teelt hebben, kunnen een belangrijke bijdrage leveren	

Table 43 - Social mechanism interview list

11.1.6 Innovation analysis:

Naam innovatie:

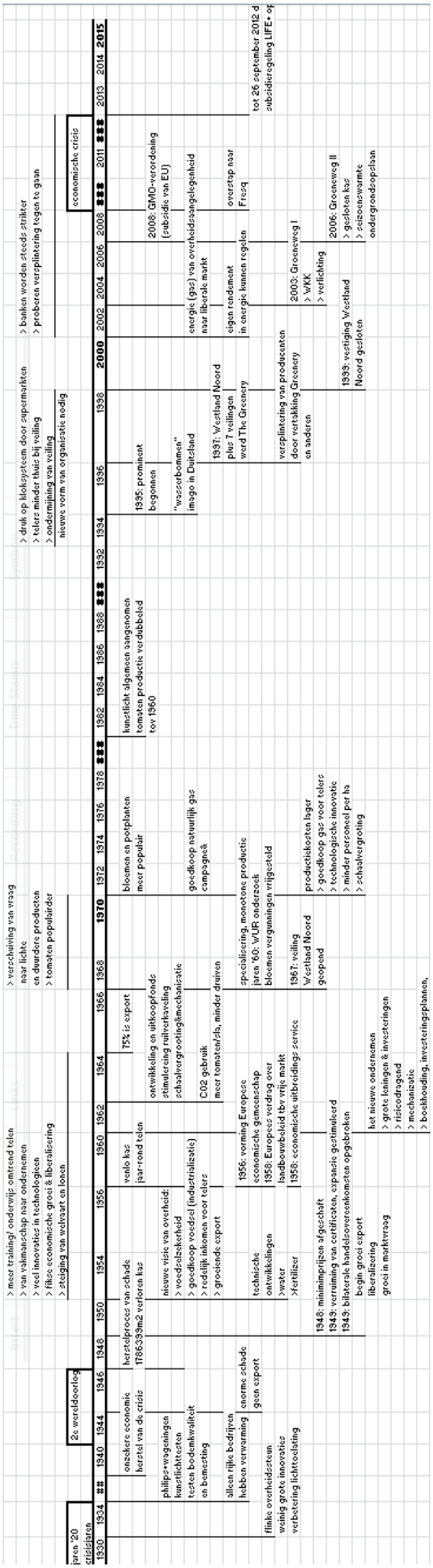
Type innovatie:

- technisch / sociaal innovatief

Invloeden:

- Persoonlijk (Hedstrom & Swedberg, 1996)
  - Relationeel
  - Bedrijfssituatie
  - Waarden
  - Voorkeuren
  - Keuze criteria
  - Persoonlijke eigenschappen
- Omgevingsfactoren
  - Marktinvloeden
  - Beschikbare resources
  - Bestaande waarde in bedrijf
- Structuur
  - Regels
  - Wetten
  - Sociale normen
  - Strategieën en routines in bedrijf
- Netwerk
  - Coöperaties
  - Grootte van netwerk
  - Type actoren in het netwerk

11.1.7 The timeline sheet



Attachment 11.2 Networks of codes

11.2.1 Used codes

HU: Westland_onderzoek
File: [C:\Users\NoorBart\Dropbox\master thesis\Atlas backup\Westland_onderzoek.hpr6]
Edited by: Super
Date/Time: 25-11-2012 17:49:56

Code neighbors list
Code-Filter: All [100]

(de)mechanisatie	Greenery
“Het was een hele nieuwe werel..	handelaren
afdwingen door markt	harde uitspraken en grappen
Als je denkt dat je het weet, ..	heterogeniteit
balans in bedrijf brengen	informatie
barriere telers/handelaren	informatie kopen
bedrijfsblindheid	innovatie
behoefte controle over product te krijgen	inovativeness van innovatie
belezen zijn	kansloze innovaties
belichting	keuze maken
bestrijding/bemesting	kopieeren
Bestuiving	markt/marketing innovatie
betrouwbaarheid van innovaties..	marktprobleem
botsing innovatie en regelgeving	mechanisatie
buitenland	minset/perceptie verandering
bulk/kostprijs	moeilijke tijden
closeness	nadeel voor kleine/innovatie bedrijven
community invloed	niet optiamle regelgeving
consumenten prijktijk ervaring	NMA
crisis effect	passieve telerhouding
cultuur	persoonlijke mijlpaal
differentiatie	politiek spel
discussies (heftige)	product innovatie/overstap

duurzaamheid	ratinaliteit
early adapter	regels aanpassen
educatie	regels niet begrijpen/er vanaf weten
familie	relaties tussen actoren
financien	risico
franchise	rol van de bank
generaties	rol van de vrouw
geschiedenis	rol van een teler
GMO	rol van gemeente
goede persoonlijke relatie	rol van LTO Glaskracht
ruimte krijgen van vader	trend/beweging volgen
samenwerking	uit gebaande paden stappen
sancties	uitvoerbaarheid van innovaties
schaalvergroting	unieke strategie
sociale duurzaamheid	vastzitten in bedriijf/markt
specialisering	verschillende telers/groepen
stage/ ervaring buitenland/ander bedrijf	volg je hart
stimuleren van innovaties door andere	voor de massa werken
stoppen met bedrijf	vrijheid/ondernemerschap
succesfactor	Vroeger
Tegenwoordig	Vroeger was het heel divers, s..
telers en wetgeving	waterrecycling/innovatie
telerssamenwerking	weerstand regels
thuisvoelen	wetgeving
timing	WKK
toevalligheden	zo gegroeid
trend	zoon stapt bedrijf in

11.2.2 Example 1

The schedule shows a simplification of the explanation of Jos Looije on his decisions and important influences and incidents in his life. It is a network view of how the labels relate to each other. The labels are the codes that were identified in Atlas.ti.

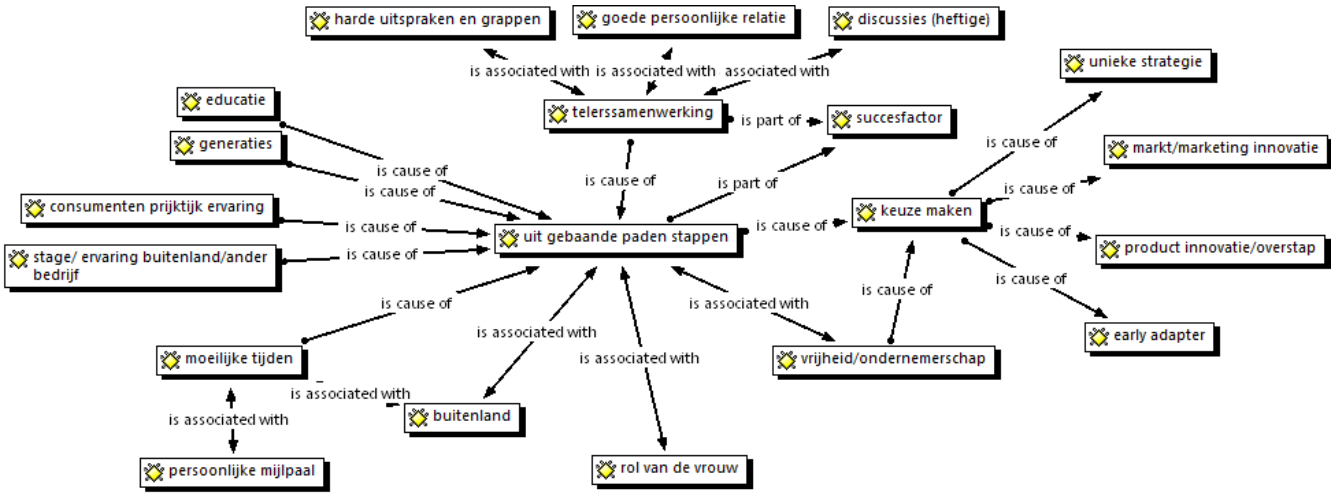


Figure 14- Network made in Atlas.ti showing assumed relation between codes

The assumed relations between codes that were identified in the interview of Jos Looije are shown in the diagram above. Some of these are assumptions are stated below:

- The **background** of the grower, being the *education, experiences, and age* are linked as variables to the ability of this grower to display **innovative behavior**.
- The **social relations**, being *close colleagues* and *intense discussions* in the case of this grower, are identified as variables stimulating **innovative behavior**.
- The **unique event**, being a personal crisis, is indicated as a causal variable to the **innovative choices** the grower has made.

These assumptions are made in this interview, resulting from the conversation with the grower on the causality of - in this case – his age, background, cooperations and experiences in life. Assumptions on the (causal) relations between the variables can then be 'tested' in further interviews, by discussing the same variables with others. In this process, patterns and dynamics can be found on a more general level, as the matter is discussed with 15 growers and another 7 experts.

11.2.3 Example 2

- The choice to increase the scale of the organization may depend on the **personal value** of the grower and his family to *stay at the same location they are living*.
- The **personal value** of *staying at the same location*, and the **strategy** to the increase the volume of the organization, may lead to a **cooperation with a neighboring organization**, which may **not be the most optimal solution for scale enlargement**.

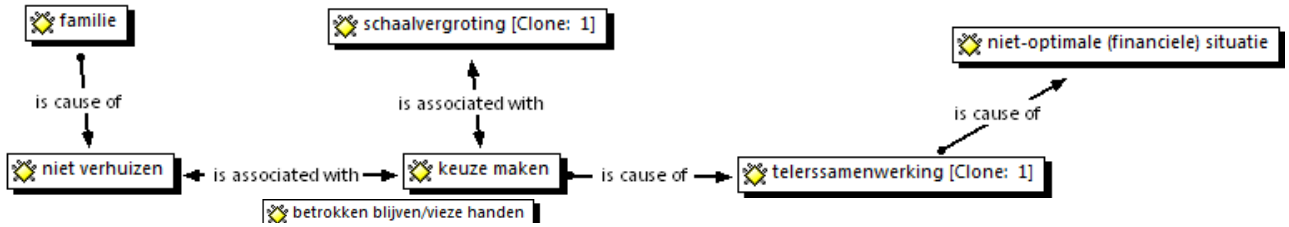


Figure 15 - Network made in Atlas.ti showing assumed relation between codes

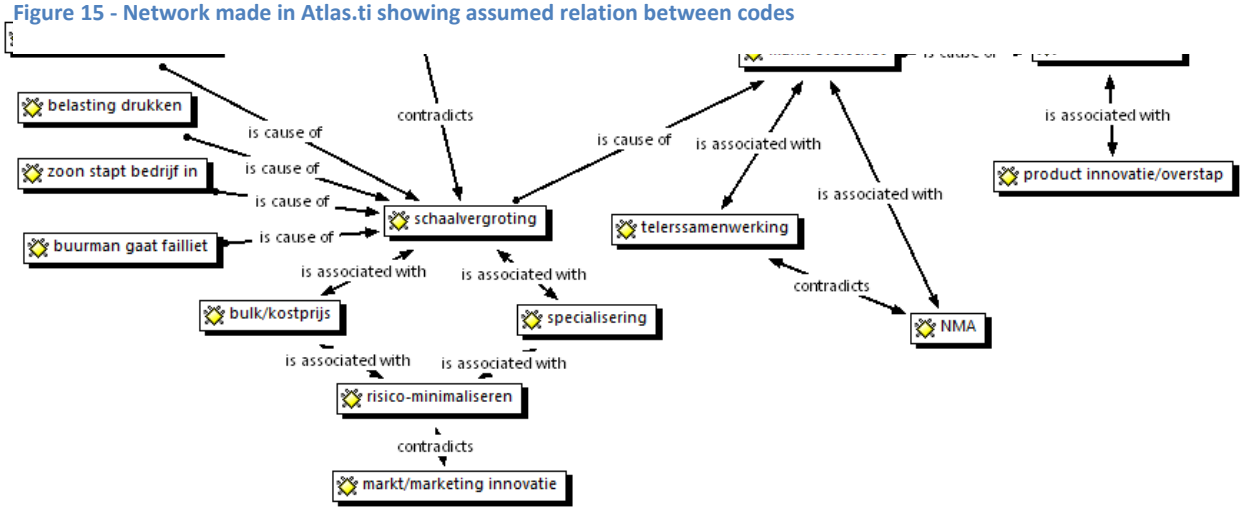


Figure 16 - Network made in Atlas.ti showing assumed relation between codes

- The reasons to apply the strategy for scale enlargement, being the **variables in the decision making for a certain innovation**, may be *following the trend, reducing the taxes, a son entering the organization, and the bankruptcy of a neighbor.*
- The **strategy of scale enlargement** may conflict with **personal value** of *being involved in the practical side of the process.*
- A often heard underlying **strategy of growers active in bulk products** is to *reduce the risks of their organization,* as the cost price of their products has to be low to survive the competition. This results in further strategies as *specializing*, to control the cost price.
- **Scale enlargement** is a cause of **overproduction** in the market
- The **cooperation of growers** may bring down the **overproduction**, as agreements can be made on the type and amount of production. However, the **regulations by the NMA** forbid these cooperations, and may therefore be identified as a potential reason **overproduction** occurs in the sector.
- Growers may choose for **product innovation**, as in many segments there is an **overproduction.** However, nowadays, almost all segments overproduction occurs.

11.3.4 Examples of memo's

Memo's are created during the process of structuring and coding the data, and are used to remember important insights by the researcher when going through the data. The memo's are important input in the analysis the fieldwork, and to identify hypothesis and suitable social mechanisms to explain the patterns.

"Naast bedrijfsblindheid kan er wellicht sectorale blindheid ontstaan. Bedrijven werken zoveel met elkaar samen dat ze meer en meer identiek worden. Het probleem hiermee is dat bedrijfsblindheid tot groepsblindheid kan uitgroeien, of zelfs sectorale blindheid. Dit zou verklaard kunnen worden door het werk van Dimaggio en Powell over Isomorphisme".

"Kapitalisme in huidige vorm walst over sociale normen heen; het gaat om goedkope krachten en kostprijs, Polen zijn daardoor gedegadeerd tot 'een blik goedkope krachten'. Dit wordt versterkt door druk van de markt en eenzijdige relatie die is gebaseerd op goedkope producten, welke gerealiseerd wordt met efficientie en kostprijs reductie. Sociale normen worden in deze bulk product ketens vrijwel niet meegenomen."

"*Dat is natuurlijk gek, die regel over water bassins geldt nu zowel voor substraat telers als grondtelers. Deze regel geldt al lang substraat telers en die hebben vaak ook die voorzieningen al om water te recycelen omdat het al lang verplicht is, dus daar zitten de problemen niet zo. Er zijn maar een paar teelten die weinig water nodig hebben, die dat ding niet willen. Maar bij de grondtelers is de doelmatigheid helemaal niet aangetoond, dus heel lang hoefden ze niet. Maar sinds 2 a 3 jaar is het voor grondtelers ook verplciht om dat ding te hebben, en daar zit heel veel weerstand, en die laten het dan ook op een rechtzaak aankomen". (Uit interview met gemeente Westland)*

Memo: Het is belagrijk diversiteit te erkennen, en niet de alleen de grote massa aan te spreken, dat maakt differentiatie en innovatie moeilijker, omdat universele regels ze uniformer maken. Door de regels te letterlijk/practisch op te leggen, worden de telers niet geprikkeld vernieuwende wegen/methoden te vinden om bepaalde standaarden te halen.

roles	discription	objective	components	entry code	institutional capability
EU	The EU can give out a subdidy called GMO to growers that fall into the criterea; investing, connected to a sales coopertion and not selling products under an own brand	Shaping the market, making it more organized	money	EU	give out GMO subsidy of 50% of investment to grower
					refuse to giveout subsidy
					fine the greenhouse owner
					witdraw the subsidy from the greenhouse owner
Municipality	Controlls the growers on regulations and may punish them	Portect people and environment; keeping growers to regulations to do so	letters, money, permits	municipality	wite a letter of notice to the grower to state the violation
					warn the grower
					fine the grower
					take juridical steps in cooperation with Bibob
LTO glaskracht	Lobbies for the growers attached to the union to change regulations	Optimzing regulations to the wishes of the mass of the members		LTO glaskracht	ease regulations
Bank	Earning money with loans, keeping organizations healthy that carry loans, getting a s much money back in case of bankrumptcy	getting investments back safely, keeping organizations healthy, reduce losses	money	Bank	give out a loan to the investor (grower)
					retrieve money
					increase the interest on loans whe organization is in trouble
					execute the organisation and withdraw money
					keep organizations alive artificially by re-investing in them while being in trouble
Merchandisers*	The merchandisers can buy products of the producers, and trade them off by refusing crops with higher prices, putting pressure on growers	making money: reducing cost at buying the products for producers and making more money by selling the products	money	trading in greenhouse products	refuse to buy products from seller and buy their products from a cheaper competitor
*** sales cooperations and supermarkets**				buying products from growers/cooperations	buy the products from the seller
				selling greenhouse products up the supply chain	

11.4 Entity-action table

Label	Institutional statement	Action body	Performer	Role enactment	Decision making *1 decision per action,*	Precondition	Postcondition	Postcondition - not do
Intrinsic capabilities of								consequence
	IC_1	be born	grower	n.a.	n.a.			n.a.
	IC_2	die	grower	n.a.	n.a.	if age is random [50 - 100]		n.a.
	IC_3	get a baby	grower	n.a.	n.a.	if age is random [25 - 35]		n.a.
	IC_4	start relation with other grower	grower	n.a.	n.a.	meet other grower	social capital: relationship + 1 tie, random [quality, closeness]	n.a.
	IC_5	adopt norms and knowlede	grower	n.a.	n.a.	go to school	social capital: knowledge + [random amount, quality, up to dateness]	n.a.
Institutions		**Behavior**						
GMO	G.1.a	get a subisidy from the EU for max 50% of an investment	Greenhouse owner	Grower takes Investor role	Take GMO subsidy	if: makes investment AND applies for subsidy AND is connected to sales cooperation AND does not use own brand	[money level + (0,5*investment)]	
	G.1.b	give out GMO subsidy of 50% of investment to grower	EU	EU	Give GMO subsidy	request from grower	[money level + (0,5*investment)]	
	G.2.a	join one of the 6 sales cooperations	Greenhouse owner	Grower takes Owner of greenhouse role	Join cooperation	if: preference = getting GMO subsidy OR preference=join sales cooperation	Property *cooperation* = official	
	G.2.b	invest in an innovation of which 50% can be civered by the subsidy	Greenhouse owner	Grower takes Owner of greenhouse role	Invest in cost-reduction	Invest in cost-reduction innovation OR Invest in volume-increase	[Money level - investment]	
	G.2.c	invest in marketing innovation for their own products	Investor	Grower takes Investor role	Invest in marketing-	Invest in marketing-innovation OR Invest in activity-extension	[Money level - investment], [property *strategy* = value-increase]	
	G.3a	refuse to giveout subsidy	EU	EU	Not give GMO subsidy	If cooperation is not official OR investment is in marketing-innovation	n.a.	
	G.3.b	fine the greenhouse owner	EU	EU	Fine/withdraw GMO subsidy	If cooperation is not official OR investment is in marketing-innovation AND subidy has	[money level - GMO subsidy]	
	G.3.c	witdrawl the subsidy from the greenhouse owner	EU	EU	Fine/withdraw GMO subsidy	If cooperation is not official OR investment is in marketing-innovation AND subidy has	[money level - GMO subsidy]	
Cooperation	C.1	start cooperation (link)	Grower	Grower taking 'member of network'	start cooperation	coopertion = [close OR official]	coopertion with other = true	
	C.2.a	invest in joint innovation	Grower	Grower taking 'member of network'	Invest in joint innovation	enough money, close cooperation OR official cooperation	new component, [money level - 0.5* investment]	
	C.2.b	share knowledge	Grower	Grower taking 'member of network'	Share knowledge	cooperation with other, have knowledge	[social capital knowledge + 1]	
	C.2.c	help financially	Grower	Grower taking 'member of network'	Lend money	cooperation with other, have money	[money level - x], [money ;evel other + x]	
	C.2.d	get help	Grower	Grower taking 'member of network'	Receive money	cooperation with other	[money level + x], [money ;evel other - x]	
	C.3.a	stop cooperation	Grower	Grower taking 'member of network'	Stop cooperation	cooperation with other	cooperation with other = false	
	C.3.b	continue operation	Grower	Grower taking 'member of network'	Continue cooperation	cooperation with other	cooperation with other = true	
loan	B.1.a	write a good investment plan that shows how an investment will be repaid	Investor	Grower taking Invester role	Apply for loan	n.a.	bank makes decision on giving out a loan	no loan possible
	B.1.b	invest in their organization	Bank	Public agent taking bank role	Make investment	Investor writes a good investment plan that shows how an investment will be repaid AND Investor invests in their organization AND investment is not value-increasing	[Money level + loan], [Innovation costs per year + (investment/year)]	no loan possible
	B.1.c	listen to bank for instructions	Client of bank	Grower taking Client of bank role	n.a.	If grower is member of bank	Bank decides to execute organization or not	n.a.
	B.2.a	refuse a grower a loan	Bank	Public agent taking bank role	Refuse loan	If Invester does not B.1.a OR not B.1.b OR does G.2.c	n.a.	n.a
	B.3	execute the organisation and withdraw money	Bank	Public agent taking bank role	Execute organization	If money level = 20% of start money level	[agent grower dies], [greenhouse for sale], [money of neigbour to bank]	n.a
	B.4	give out a loan to the investor (grower)	Bank	Public agent taking bank role	Give out loan	If B.1.a AND B.1.b AND not: G.2.c	[Money level grower + loan], [Innovation costs per year + (investment/year)]	n.a
	B.5	increase the interest on loans whe organization is in trouble	Bank	Public agent taking bank role	Increase interest	Oganization has 20% of initial money level	[Increase innovations costs with 10%]	n.a.
	B.5	keep organizations alive artificially by re-investing in them while being in trouble	Bank	Public agent taking bank role	Re-investing in organisation	Much money in organization already	[Accept loan request]	n.a.
Selling	M.1.a	calculate product price	Seller	Grower taking Seller role	calculate product price	if produdcts available	[have product price]	
	M.1.b	offer products to the merchandisers	Seller	Grower taking Seller role	offer products to the	if products available and market price is cal	[merchandiser makes decision on offer]	
	M.1.c	sell producst to merchandiser	Seller	Grower taking Seller role	sell producst to	if merchandisers buys from grower	[add money to money level] [take sold products from stock]	
	M.2.	drop their prices to competitive prices compared to other grower's prices	Seller	Grower taking Seller role	drop their prices to competitive	if merchandisers do not buy for the previous price	[market price - 10%]	[keep same market price]
	M.3.a	refuse to buy products from seller and buy their products from a cheaper competitor	Merchansider	Public agent taking Merchandiser role	refuse to buy products from seller and buy	if price of product is higher than the norm	[product value = added value]	[product value = cost price value]
	M.4	buy the products from the seller	Merchansider	Public agent taking Merchandiser role	buy the products from the seller	if price of products is below the norm	[Money level grower + loan], [Innovation costs per year + (investment/year)]	n.a.

Learning	S.1	adopt new norms and knowledge on horticulture business	Greenhouse owner	Grower taking Owner role		having eductaion	[social capital knowledge + 1]	n.a.
Lobbying	L.1	give their opinion on regulations etc	Client of bank	Grower taking greenhouse owner role	*leaving this out*	*leaving this out*	*leaving this out*	
	L.2	lobby against regulations	LTO Glaskracht	LTO Glaskracht	*leaving this out*	*leaving this out*	*leaving this out*	
Regulations	R.1	obey the regulations that are observed by the municipality by investing in prescribed innovations	Client of bank	Grower taing greenhouse owner role				
	R.2a	wite a letter of notice to the grower to state the violation	Municipality	Public agent taking Municipality role	Punishment	if the grower responses pro-active/indifferent and violation is not so	none	n.a.
	R.2b	warn the grower	Municipality	Public agent taking Municipality role	Punishment	if the grower is indifferent/structurally violating and the violation is more	none	n.a.
	R.2c	fine the grower	Municipality	Public agent taking Municipality role	Punishment	if the grower is indifferent/structurally violating and the violation is more	[money level - fine]	n.a.
	R.2d	take juridical steps in cooperation with Bibob	Municipality	Public agent taking Municipality role	Punishment	if the violation is severe/irreversible and the grower is consiously and structurally	[money level - large fine]	n.a.
Informal								
	I.1	produce products in line of all the quality and safety standards when cooperating	Grower	Grower taking greenhouse owner role				
	I.2	produce the maximum Kg per m2 as much as they can	Grower	Grower taking greenhouse owner				
	I.3	reduce their cost price per Kg as much as they can to levels of competitors	Grower	greenhouse owner role				
	I.4	sell their products for too low prices close or under cost price	grower	Grower taking greenhouse seller				
	I.5	refuse to cooperate with the grower anyore	Grower	Grower taking greenhouse owner				
	I.6	increase the interest on loans whe organization is in trouble	Bank	Public agent takeing bank role				
	I.7	keep organizations alive artificially by re-investing in them while being in	Bank	Public agent takeing bank role				
strategies								
strategy	S.1	copy the succesful innovations of a collegue	Grower	Grower taking investor role		chance: 0,4		
	S.2	make own decision on innovation type	Grower	Grower raking investor role		chance: 0,4		
	S.3	invest in random innovation	Grower	Grower raking investor role		chance: 0,1		
	S.4	join in on innovation of other grower	Grower	Grower raking investor role		chance: 0,1		
	S.5	plant new crops	Grower	Grower taking owner of greenhouse role				
	S.6a	buy water	Grower	Grower taking owner of greenhouse role				
	S.6b	buy nutrients	Grower	Grower taking owner of greenhouse role				
	S.6c	buy energy	Grower	Grower taking owner of greenhouse role				
	S.7	harvest crops	Grower	Grower taking owner of greenhouse role			give product code [random 1 - 30]	
	S.8	start cooperation with other grower	Grower	'member of network' role				
	S.9	make joint decision to rise prices alltogether	Growers (all)	All growers				
Investments								
	IC.1	Invest in a cost reducing newness	Grower	Grower takes Investor role	Invest in a cost reducing	Having money	Add that component to organization, subsyract money from money level	
	IC.2	Invest in a volume increasing newness	Grower	Grower takes Investor role	Invest in a volume	Having money	Add that component to organization, subsyract money from money level	
	IC.3	Invest in an activity-increasing newness	Grower	Grower takes Investor role	Invest in an activity-increasing	Having money	Add that component to organization, subsyract money from money level	
	IC.4	Invest in a value-increasing newness	Grower	Grower takes Investor role	Invest in a value-	Having money	Add that component to organization, subsyract money from money level	
	IC.5	Invest in a oblidged newness	Grower	Grower takes Investor role	Invest in a oblidged	Having money	Add that component to organization, subsyract money from money level	
	S.8	start cooperation with other grower	Grower	Grower taking member of network role	start cooperation with other	yearly	relationship +1	
	S.9	make joint decision to rise prices alltogether	Grower	Growe taking owner of greenhouse role	make joint decision to	NMA gone	higher prices	trading off
	S.11	apply for GMO subsidy	Grower	Grower takes Investor role	apply for GMO subsidy	if there is no price-increasing component	GMO allows or rejects request	
effect of innovation								
	E.1	produce products in line of all the quality and safety standards	Grower	Grower takes 'owner of greenhouse role'		value of product > x		orther growers stop coopertion
	E.2a	reduce costs	cost-reducing component			investment in cost-reducing component	reduce costs [random from water, energy, nutrients]	
	E.2.b	increase the volume	volume-increasing component			investment in valume-increaisng component	increase number of products	
	E.2c	increase product value	price-increasing component			investment in proudct-increasing component	add value to product	
	E.2d	extend product/service				investment in product-extending component	give product-code [random 31 - 41] ,AND add value to product	
	E.3	create ROI	Grower	grower taking invstor role		(sales price - costs = ROI)	innovation is succesful can can be copied	
	3.4	break down	physical components			age = 10		
	E.5a	consuming energy	Grower	Grower takes 'owner of greenhouse role'		plant new crops, have money	substract money from money level, continue proces	stop proces
	E.5.b	consuming nutrients	Grower	Grower takes 'owner of greenhouse role'		plant new crops, have money	substract money from money level, continue proces	stop proces
	E.5.c	consuming water	Grower	Grower takes 'owner of greenhouse role'		plant new crops, have money	substract money from money level, continue proces	stop proces

Table 44 - Entity-action table

List of references

J. Acheson. Ostrom for anthropologists. *International Journal of the Commons,* 5(2): 319, 2011.

O.J. Andersen. A Bottom-Up Perspective on Innovations: Mobilizing Knowledge and Social Capital Through Innovative Processes of Bricolage. *Administration and Society,* 40 (54), 54-76, 2008.

R.L. Axtell, C.J. Andrews, and M.J. Small. Agent-Based Modeling and Industrial Ecology. *Journal of Industrial Ecology,* 5 (4): 10-13, 2008.

E. R. Babbie, *The practice of social research* (Belmont 2004).

A. Balžekienė, E. Butkevičienė and A. Telešienė. Social impact of technological innovations. Methodological framework for analyzing social impact of technological innovations. *Social Sciences/Socialiniai okslai,* 1 (59): 71-80, 2008.

S.R. Barley and P.S. Tolbert. Institutionalization and Structuration: Studying the Links between Action and Institution. *Organization Studies*, 18(1): 93-117, 1997.

X. Basurto, G. Kingsley, K. Mcqueen, M. Smith and C.M. Weible. A Systematic Approach to Institutional Analysis: Applying Crawford and Ostrom's Grammar. *Political Research Quarterly,* 63 (3): 523-537, 2010.

E. Berkers and F.W. Geels. System innovation through stepwise reconfiguration: the case of technological transitions in Dutch greenhouse horticulture (1930-1980). *Technology Analysis & Strategic Management,* 23 (3): 227-247, 2011.

F. Boons. Caught in the web: the dual nature of networks and its consequences. *Business Strategy and the Environment,* 7: 204-212, 1998.

P. Bourdieu, *Outline of a theory of practice* (Cambridge 1977).

J.D. Brewer, *Ethnography* (Philidelphia 2000).

E. Butkevičienė. Social Innovations in Rural Communities. Methodological Framework and Emperical Evidence. *Social Sciences/Socialiniai mokslai,* 1 (63): 80-88, 2009.

P.J. Carrington, J Scott and S. Wasserman, *Models and methods in social network analysis* (Cambridge 2005).

N. Cavalli. The Symbolic Dimension of Innovation Processes. *American Behavioral Scientist,* 50 (7): 958-969, 2007.

M. Chertow and J. Ehrenfeld. Organizing Self-Organizing Systems. Toward a Theory of Industrial Symbiosis. *Journal of Industrial Ecology,* 16 (1): 13-27, 2012.

J. H. Cohen, *Economic development. An anthropological approach* (Walnut Creek 2002).

J.S. Coleman. Social Theory, Social Research, and a Theory of Action. *American Journal of Sociology*, 91 (6): 1309-1335, 1986.
M.T. Dacin, J. Goodstein and W.R. Scott. Institutional Theory and Institutional Change: Introduction to the Special Research Forum. *Academy of Management Journal,* 45(1): 45-57, 2002.

F. Dal Fiore. Communities Versus Networks The Implications on Innovation and Social Change. *American Behavioral Scientist,* 50 (7): 857-866, 2007.

G. DeSanctis and M.S. Poole. Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory. *Organization Science,* 5 (2): 121-147, 1994.

P.J. DiMaggio and W.W. Powell. The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields. *American Sociological Review,* 48 (2): 147-160, 1983.

J. Elster, *Explaining Social Behavior. More Nuts and Bolts for the Social Sciences* (Cambridge 2007).

B. Elzen, F.W. Geels, C. Leeuwis and B. van Mierlo. Normative contestation in transitions 'in the making': Animal welfare concerns and system innovation in pig husbandry. *Research Policy*, 40 (2): 263-275, 2011.

J.M. Epstein and R. Axtell, *Growing artificial societies. Social science from the bottom up* (Massachusetts 1996).

M.D. Fischer, *Applications in computing for social anthropologists* (London 1994).

M.D. Fisher. Counting things and interpreting ideas : anthropological conventions in the use of "hard" versus "soft" models, in: M.D. Fisher ed., *Representing natural resource development in Asia: "modern" versus "postmodern" scholarly authority* (Canterbury 1998)

M.D. Fischer. Integrating Anthropological Approaches to the Study of Culture: The Hard and the Soft. *Cybernetics and Systems: An International Journal,* 35 (2-3): 147-162, 2004.

L.C. Freeman and D.R. White, *Research methods in social network analysis* (Fairfax 1989).

F.W. Geels. From sectoral systems of innovation to socio-technical systems. Insights about dynamics and change from sociology and institutional theory. *Research Policy,* 33 (6-7): 897-920, 2004.

F.W. Geels, B. Elzen, E. Berkers, C. Leeuwis and B. van Mierlo, *Historische en hedendaagse systeem-innovaties in de glastuinbouw en varkenshouderij. Een innovatie-sociologische analyse* (2008).

F.W. Geels. Ontologies, socio-technical transitions (to sustainability), and the multi-level perspective. *Research Policy,* 39: 495-510, 2010.

A. Ghorbani, V. Dignum and G. Dijkema. An Analysis and Design Framework for Agent-Based Social Simulation. *Advanced Agent Technology. Lecture Notes in Computer Science,* 7068: 96-112, 2012.

A. Ghorbani. MAIA: A Framework for Developing Agentbased Social Simulations (To be published).

A. Giddens, *Central problems in social theory. Action, structure and contradiction in social analysis* (London 1979).

A. Giddens, *New rules of sociological method. A positive critique of interpretative sociologies* (London 1976).

A. Giddens, *The constitution of society. Outline of the theory of structuration* (Cambridge 1984).

P. Hedström and R. Swedberg, *Social Mechanisms. An analytical approach to social theory* (Cambridge 2007).

K. Ho, *Liquidated: an ethnography of Wall Street* (Durham 2009).

C. Hoffer, R.D. Rahman, and P.J.M. Nas, *Niet zeuren, maar gaan als een speer. Een onderzoek naar jongerenproblematiek en jongerenbeleid in het Westland* (Leiden 1985).

J. Howald and M. Schwarz. *Social Innovation: Concepts, research fields and international trends* (Dortmund 2010).

C. Kingston and G. Caballero. Comparing Theories of Institutional Change. *Journal of Institutional Economics,* 5 (2): 151-180, 2009.

J. Korhonen, F. Von Malmborg, P.A. Strachan and J.R. Ehrenfeld. Management and policy aspects of industrial ecology: an emerging research agenda. *Business Strategy and the Environment*, 13: 289-305, 2004.

J.S. Lansing and J.N. Kremer. Emergent Properties of Balinese Water Temple Networks: Coadaptation on a Rugged Fitness Landscape. *American Anthropologists,* 95 (1): 97-114, 1993.

J. S. Lansing, *Perfect order. Recognizing complexity in Bali* (Princeton 2006).

M.W. Macy and R. Willer. From Factors to Actors; Computational Sociology and Agent-Based Modeling. *Annual Review of Sociology,* 28: 143-166, 2002.

G.E. Marcus, *Ethnography through thick and thin* (Princeton 1998).

J.P. Mayer, C.H. Blakely and W.S. Davidson. Social Program Innovation and Dissemination: A Study of Organizational Change Processes. *Policy Studies Review,* 6 (2): 273-286, 1986.

E.W.B. van den Muijzenberg*, A history of greenhouses* (Wageningen 1980).

G. Mulgan. The Process of Social Innovation. *Innovations,* 1 (2): 145-162, 2006.

D.C. North. Institutions. *The Journal of Economic Perspectives,* 5 (1): 97-112, 1991.

E. Ostrom, *Institutional incentives and sustainable development. Infrastructure policies in perspective* (Boulder 1993).

E. Ostrom, *Understanding institutional diversity* (Princeton 2005).

J.G. de Ridder, *Uit de geschiedenis van het Westland* (Den Haag 1979).

E.M Rogers, *Diffusion of innovations* (New York 1983).

J. Rooke, D. Seymou and R. Fellows. Planning for Claims. An Ethnography of Industrial Culture. *Construction Management and Economics,* 22 (6): 655-662, 2004.

S. Roth. New for whom? Initial images from the social dimension of innovation. *International Journal of Innovation and Sustainable Development,* 4 (4): 231 – 252, 2009.

M. Schillo, K. Fischer and C.T. Klein. The micro-macro link in DAI and sociology. *Multi-agent-based Simulation*, 1979: 133-148, 2001.

R.W. Scott, *Institutions and organizations. Ideas and interests* (Los Angeles 2008).

B. Smart. Foucault, Sociology, and the Problem of Human Agency. *Theory and Society,* 11 (2): 121-141, 1982.

A. Swidler. Culture in Action: Symbols and Strategies. *American Sociological Review,* 51 (2): 273-286, 1986.

J.A.A.M. Verstegen and T.L. Lans, *De kunst van het zien en het realiseren. Competenties voor succesvol ondernemerschap in de agrarische sector* (Den Haag 2006).

A.J. Vijverberg, *Glastuinbouw in ontwikkeling. Beschouwingen over de sector en de beïnvloeding ervan door de wetenschap* (Delft 1996).

G. Watson. Resistance to Change. *American Behavioral Scientist,* 14 (5): 745-766, 1971.

R.R. Wilk and L. Cligget, *Economies and cultures. Foundations of economic anthropology* (Boulder 2007).

H. P. Young, *Individual strategy and social structure. An evolutionary theory of institutions* (Princeton 2001).

G. Zaltman and N. Lin. On the Nature of Innovations. *American Behavioral Scientist,* 14 (5): 651-673, 1971.

Websites:

Website of LTO Glaskracht: http://www.ltonoordglaskracht.nl/ (visited in 2012)

Webtite of the NMA: http://www.nma.nl/default.aspx (visited in 2012)

Website of gemeente Westland: http://www.gemeentewestland.nl/Smartsite.shtml?id=139516 (visited in 2012)