

# AGRICULTURE IN THE NETHERLANDS, KNOWING THE RULES, RULING THE KNOWLEDGE

IN THREE REGIMES: AGRICULTURAL SCIENCE, FARMING AND VOCATIONAL EDUCATION

---

Report: Msc Thesis

Author: Suzanna van der Meer

Studentnumber: 880622552030

Programme: Master International Developmentstudies

Chair group: Knowledge, Technology and Innovation

Supervisor: Dr. Barbara van Mierlo

Date: August 22<sup>nd</sup>, 2018



## ABSTRACT

This study provides an overview of the rules (in the broad sense of the word) that are present in three regimes related to agriculture in the Netherlands: the vocational education regime, the production regime and the agricultural science regime. Assessing rules in each regime according to the three types—normative rules, regulative rules and socio-cognitive rules—uncovered several stabilizing mechanisms. In this study, a strong emphasis is placed on the role and different types of knowledge and on knowledge creation, diffusion and use. The findings show that different epistemic cultures and perceptions of what is legitimate knowledge and how to create knowledge should not be underestimated as an influence and challenge in change processes in agriculture.

## Summary

In the Netherlands, we encountered an increase in water pollution and loss of biodiversity. The Broad Wealth Monitor of the Central Statistics Office (CBS, 2018) shows that 'natural capital' went down drastically in the Netherlands, especially the indicators 'water quality' and 'biodiversity' decreased in 2017 (CBS, 2018). Since agriculture is an important source of water pollution and loss of biodiversity in the Netherlands, Van Dijk et al. (2018) state that a transition is needed to reach harmony again with nature, the environment and the landscape. Moreover, they indicate transformation failure caused by the absence of appropriate and effective regulations in agriculture in the Netherlands. While they mostly talk about regulative rules, the study at hand investigated three types of change-obstructing rules: regulative, socio-cognitive and normative rules. Participatory research, semi-structured interviews with stakeholders from the different regimes and desk research were carried out to answer the main research question:

How do stabilizing rules in the vocational education, agricultural production and science regimes obstruct change toward more Nature Inclusive Agriculture in the Netherlands, and how do they relate to epistemic cultures?

A two-layered analytical framework was used to analyze the data, consisting of two main concepts: the three types of rules of Scott (and their stabilizing effects on regimes) and epistemic cultures. As shown in the figure below, the relations between the three types of rules will be analyzed.

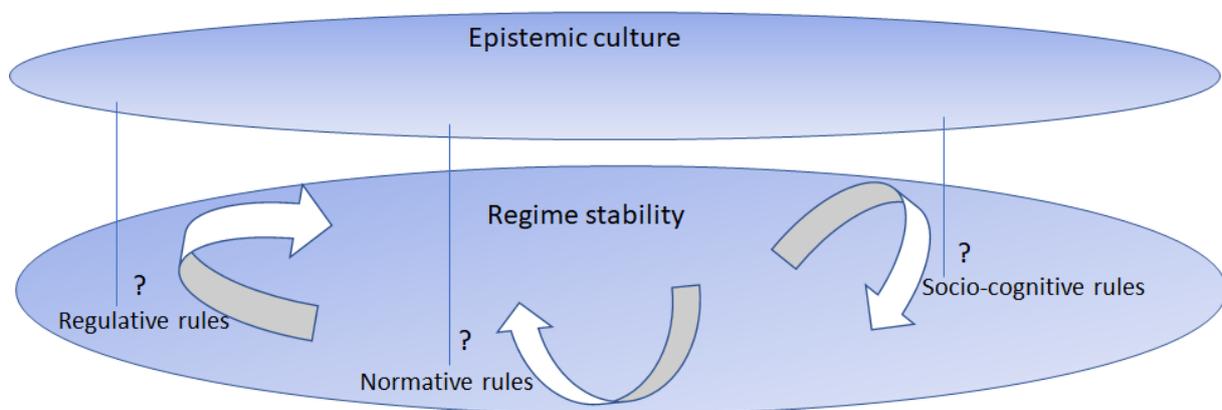


Figure 1. Analytical framework to study regime stability

This study provides an overview of the rules (in the broad sense of the word) that are present in three regimes related to agriculture in the Netherlands: the vocational education regime, the production regime and the agricultural science regime. Assessing rules in each regime according to the three types—normative rules, regulative rules and socio-cognitive rules—uncovered several stabilizing mechanisms. In this study, a strong emphasis is placed on the role and different types of knowledge and on knowledge creation, diffusion and use. These can be studied as elements of distinct epistemic cultures. The concept of epistemic culture is used to

analyze the data and trace potential relations between these cultures and stabilizing regime rules. The findings of the study at hand show the importance of recognizing distinct epistemic cultures and their stabilizing effects on interlinked regimes in the agricultural system in the Netherlands, i.e. perceptions of which knowledge is legitimate, which knowledge is relevant, and how to create and validate knowledge.

## ACKNOWLEDGEMENTS

In the first place I would like to thank my supervisor, Barbara van Mierlo, for her guidance and optimism. This support meant a lot for me. I am grateful for the way she helped me to structure the thoughts (in my chaotic mind) and the positive way she phrased comments. Without her this process and the end product would not have been the same. I want to thank the interviewees who were willing to share their insights, experience and ideas with me. The conversations with them were the part of the research I enjoyed most. Another very interesting part of this research was the time I spent with farmers, doing participatory research. I am grateful to the Foundation for Natural Livestock Farming, for welcoming me in their group of farmers and veterinarians in the course of the past two years during various meetings, a conference and a trip to India. Especially being surrounded by farmers, gave me insights that were crucial for my understanding of their life worlds. My special thanks go to the head of the Foundation Livestock Farming, Katrien van't Hooft. Talking with her was always a great pleasure and motivation, thanks to her warm character, critical view and unstoppable ambition to improve livestock farming in a natural way.

I am grateful to my wonderful, caring friends and housemates who supported me by being present in my live and giving me a feeling of belonging after days of getting lost in the process of this thesis. Thank you for all the delicious dinners, I will make up for that, when this is finished. Marjolein, thank you for your solidarity, spending your day with me pretending you were working as well. My family, I want to thank for their patience, understanding and tolerance, even when I was tensed because of the thesis, your love empowers me. Last but not least, my gratitude goes to Jacob for proofreading my concept thesis, in times when this still appeared to be a crossword puzzle, with your help I found back some logics and managed to structure it into what it now is. You made me enjoy working on my thesis again and gave me back my confidence.

## TABLE OF CONTENTS

Abstract	2
<b>Summary</b>	<b>3</b>
Acknowledgements	5
Table of Contents	6
Abbreviations	8
1. Introduction	9
1.1 Problem statement and research objective	9
1.2 Research questions	10
1.3 Scientific relevance	11
1.4 Societal relevance	11
1.4 Structure of this thesis	11
2. Theoretical Framework	13
2.1 The three types of rules of Scott supporting regimes	13
2.2 Stabilization in the regimes	14
2.3 Epistemic cultures and the role of Knowledge	16
2.4 Analytical framework	18
3. Material and methods	18
3.1 Data collection	18
3.2 Data analysis	19
3.3 Research limitations	19
4. Results	20
4.1 The Agricultural production regime	20
Normative rules in the agricultural production regime	20
Regulative rules in the agricultural regime	22
Socio-cognitive rules in the agricultural regime	24
Summary of the rules in this regime	25
Epistemic culture(s) in the farmers' regime	26
4.2 The Science regime	28
Normative rules in the science regime	28
Regulative rules in the science regime	29
Socio-cognitive rules in the science regime	31
Summary of the rules in this regime	33
Epistemic culture(s) in the science regime	34
4.3 The Vocational education regime	35
Normative rules in the vocational education regime	35

Regulative rules in the vocational education regime	37
Socio-cognitive rules in the vocational education regime	38
Summary of the rules in this regime	40
Epistemic culture(s) in vocational agricultural Education	40
5. Conclusion and discussion	42
5.1 Conclusion	42
Question 1	42
<b>Regulative</b>	42
<b>Normative</b>	42
<b>Socio-cognitive</b>	42
Question 2	43
Question 3	44
Main research question	46
5.2 Discussion	46
5.3 Recommendations	49
References	50
Appendix I	54
Appendix II	55
Appendix III	56
Appendix IV	56

## ABBREVIATIONS

AOC =	Agrarisch Opleidingscentrum (EN: Centre for Agricultural Education)
CBS =	Centraal Bureau voor de Statistiek (EN: Central Statistics Office)
GKC =	Groene Kennis Cooperatie (EN: Green Knowledge Cooperation)
IPES-Food =	International Panel of Experts on Sustainable Food Systems
MT =	Management Team
NIA =	Nature Inclusive Agriculture
NLF =	Foundation for Natural Livestock Farming
TDU =	Institute for Trans-Disciplinary Health Sciences and Technology
UU =	Utrecht University
WUR =	Wageningen University & Research

## 1. INTRODUCTION

### 1.1 PROBLEM STATEMENT AND RESEARCH OBJECTIVE

In the Netherlands, encountered an increase in water pollution and loss of biodiversity. The Broad Wealth Monitor of the Central Statistics Office (CBS, 2018) shows that 'natural capital' went down drastically in the Netherlands as compared to other EU countries (appendix II). Especially the 'natural capital' indicators 'water quality' and 'biodiversity' decreased in 2017 (CBS, 2018). An illustrative and serious result is the decline in pollinators: "pollinator declines can result in loss of pollination services, which have important negative ecological and economic impacts that could significantly affect the maintenance of wild plant diversity, wider ecosystem stability, crop production, food security and human welfare" (Potts et al., 2010, p. 345). Agriculture is mentioned as a field affected by the negative results, but above all, it is an important source of water pollution and loss of biodiversity in the Netherlands (Rijksoverheid, 2016). Accordingly, Van Dijk et al. (2018) state that agriculture has reached its limits in the Netherlands and that a transition is needed to reach harmony again with nature, the environment and the landscape. Moreover, they indicate that transformation failure (Weber & Rohrer, 2012) is caused by the absence of appropriate and effective regulations in agriculture in the Netherlands.

Van Dijk et al. (2018) suggest that it is clear by now why a transition to nature-inclusive agriculture is needed, yet attention is required for how to achieve this. They suggest that transition failure results from regulative rules in the agricultural production regime not enabling transition. The study at hand will also investigate stabilization related to two other types of rules: socio-cognitive and normative rules (next to the regulative rules). The use of the concepts of rules and regimes in this study was inspired by Kemp, Schot & Hoogma (1998), who use the concept of 'rules' to explain the pre-structured context in which actors tend to look for certain ways of problem-solving rather than others, and 'rules' as the governing elements that determine 'the privileged way forward' in developments in a regime.

The three types of rules will be studied in three regimes: the agricultural production regime, the vocational education regime and the science regime. Besides the stabilizing effect of the above-mentioned rules on the regimes, this study will analyse the stabilizing effect of epistemic cultures in and among the regimes.

These epistemic cultures concern the role of and approach to knowledge and knowledge creation. A transition in the agricultural system requires different types of knowledge and knowledge creation and diffusion, including farmers' knowledge (IPES, 2016; De Nooy-van Tol, 2013; Wiskerke & Van der Ploeg, 2004). Leeuwis (2000) also indicated the importance of developing knowledge of a different nature than the knowledge required for conventional agricultural practices. Moreover, Wiskerke & Van der Ploeg (2004, pp. 78–79) highlight the importance of contextualised farmers' knowledge in sustainable innovations in agriculture. They explain that societal pressure to reorient agriculture to more sustainable production since the 1970s led to the increased interest in farmers' knowledge. This had multiple reasons, such as: "the discovery that such knowledge is indispensable in view of the need to re-balance growth factors, increased recognition of the

significance of diversity in agriculture, and changed perceptions about the nature of innovations and innovation processes” (Wiskerke & Van der Ploeg, 2004, p. 94). Moreover, they mention the knowledge of farmers as an important source for understanding the possibilities of ecosystem management and transformation (idem, p. 95). So, for a transition to come about, farmers’ knowledge (with its features distinct from scientific knowledge) can play an important role.

In this study, the concept ‘regime’ will be used to study ‘knowledge’, an approach inspired by Hobart (1993). He explained that a regime prescribes a specific distribution of knowledge and ignorance, which indicates the ‘privileged way forward’ (Hobart, 1993). The study at hand assumes that regime actors’ anticipation of the ‘privileged way forward’ can have a stabilizing effect and thereby may obstruct changes required for ‘different ways forward’. Moreover, the study at hand suggests that the organisation of knowledge and knowledge creation, and the distinct epistemic cultures of the regimes, could be a bottleneck for transitions. In line with various scholars (e.g. Lieshout et al., 2013; Wiskerke, 2003; Erjavec & Erjavec, 2009; Hobart, 1993), this study aims to analyse the predominance of developments serving the dominant perception of the ‘privileged way forward’ in the agricultural system. The domination of intensive agriculture embeds and legitimizes itself through a powerful dominant discourse amplified in research, policy-making and practices (Lieshout et al., 2013). According to Lieshout, Dewulf, Aarts and Termeer (2013), governmental policymakers in the Netherlands have continuously been framing issues in a way that ‘scale increase’ would be the solution for the Dutch agricultural sector, i.e. the ‘privileged way forward’. Nowadays, the minister gives recognition to the need to make changes in the agricultural system by measures under the term ‘Nature Inclusive Agriculture’ (explained in more detail in appendix II). The main question in the study at hand therefore refers back to this term, and the study will investigate how changes toward more Nature Inclusive Agriculture are obstructed.

## 1.2 RESEARCH QUESTIONS

The situation described above, caused me to pose the following research questions:

How do stabilizing rules in the vocational education, agricultural production and science regimes obstruct change toward more Nature Inclusive Agriculture in The Netherlands and how do they relate to epistemic cultures?

- Which change obstructing rules (cognitive, normative and regulative) are at play in the three regimes that are part of the agricultural system in the Netherlands?
- How do these rules relate to regime stability in the agricultural system?
- What is the role of knowledge and different epistemic cultures in the developments in the Dutch agricultural sector, and how does it affect regime stability?

### 1.3 SCIENTIFIC RELEVANCE

As described above this work tests the approach suggested by Geels (2004) which aims to uncover stabilisation in regimes by studying regime rules. So assuming this works, this will give insights into the actors' practices and their argumentation for doing what they do in terms of three types of rules, normative, socio-cognitive and regulative. Besides the sociological concept of 'rules', this study will explore the role of another concept originating from philosophy instead, 'epistemic cultures' (Knorr-Cetina, 1999). Both concepts will be tested as analytical tools in exploring the stability of regimes. Moreover, the study at hand aims to assess whether and how distinct epistemic cultures relate to the distinct types of rules of Scott (2008), thereby exploring mutual reinforcement of change-obstructing rules and epistemic cultures' stabilizing effect on regimes.

### 1.4 SOCIETAL RELEVANCE

Research journalists Bouma & Marijnissen (2018) reported that farmers would like to change and become more sustainable, if only there would be clarity in the agricultural policies. In line with this, the International Panel of Experts on Sustainable Food Systems report (IPES-Food, 2016) underlines that complexity and interlinkages at the farm level are often not recognized in research, since researchers are trained in their own specific discipline. The authors of the IPES-Food report fear that this will keep reinforcing the same agricultural system by scientific publication supporting policies which build on the assumptions of specific disciplinary knowledge in isolation: *"The compartmentalization in research, policy and farm industry structures is mutually reinforcing. The agricultural policies made in isolation depend on the knowledge emanating from the corresponding agricultural silo of the research world. Agricultural sector bodies are organized to convey this knowledge to farmers, who in turn rely on agricultural subsidies and other political support measures geared towards raising crop productivity and net production."* (IPES-Food, 2016). This study is relevant, assuming that farmers would like to change, that rules and distinct epistemic cultures which obstruct these changes (directly or via policies) need to be uncovered.

### 1.4 STRUCTURE OF THIS THESIS

This thesis consists of five chapters. Chapter 1 introduces the research, first by presenting the problem statement and the research objective, and then the research questions. This chapter also sketches the scientific and societal relevance and the structure of this thesis. Chapter 2 gives an overview and explanation of the theoretical concepts that guide the study. Chapter 3 describes the research approach and the methods used for data collection and analysis. The results chapter, Chapter 4, consists of a separate section for each of the three regimes, 4.1 The Production regime, 4.2 The Science regime and 4.3 The Vocational education regime. This chapter aims to identify what is causing stability in the distinct regimes. The three sections in Chapter 4 each contain five subsections, the first three on the distinct types of rules in the regime (1. Normative, 2. Regulative and 3. Socio-cognitive) followed by a summarizing section of these three rules and their interactions, and finally

a subsection in each regime-section addressing the distinct epistemic cultures of the regimes. The last chapter, Chapter 5, consists of a conclusion in which the research questions are answered, a discussion of the research and its implications, and reflections on the research with the help of existing literature. The last chapter closes with recommendations, based on both the societal and scientific relevance of this research.

## 2. THEORETICAL FRAMEWORK

In this chapter, first the types of rules identified by Scott are described (2.1); then, in section 2.2, the stabilizing effects these rules can have are explained. Section 2.3 underlines the importance and significance of knowledge and epistemic cultures. This chapter concludes with an analytical framework.

### 2.1 THE THREE TYPES OF RULES OF SCOTT SUPPORTING REGIMES

The concept of ‘rules’ will be core in determining regimes in the study at hand. To be more precise, the different kinds of rules distinguished by Scott (2008) are divided into three types: regulative, normative, and cognitive rules. According to Scott, these three types of rules can be used to explain individual and collective behaviour in institutions and organisations, each rule type with its own basis for compliance. These compliance mechanisms per rule type, as well as the distinct logics and basis of legitimacy for each of the three kinds of rules, are presented in table 1.

	Regulative	Normative	Cognitive
Examples	Formal rules, laws, sanctions, incentive structures, reward and cost structures, governance systems, power systems, protocols, standards, procedures	Values, norms, role expectations, authority systems, duty, codes of conduct	Priorities, problem agendas, beliefs, bodies of knowledge (paradigms), models of reality, categories, classifications, jargon/language, search heuristics
Basis of compliance	Expedience	Social obligation	Taken for granted
Mechanisms	Coercive (force, punishments)	Normative pressure (social sanctions such as ‘shaming’)	Mimetic, learning, imitation
Logic	Instrumentality (creating stability, ‘rules of the game’)	Appropriateness, becoming part of the group (‘how we do things’)	Orthodoxy (shared ideas, concepts)
Basis of legitimacy	Legally sanctioned	Morally governed	Culturally supported, conceptually correct

Table 1. The three types of rules and distinct emphasis (source: Scott, 1995 in Geels, 2004)

The *regulative, normative, and socio-cognitive rules* bring about processes which exhibit meaning-making and stabilizing properties in institutions (p.57 Scott 2008). The rules relate to arguments for (individual or collective) compliance with rules and regulations, possibly bringing about change-obstructing effects. Scott (2008) suggests these arguments can be: “because they are rewarded for doing so, because they believe that they are morally obligated to do so, or because they are following their conception of what reasonable others would do in the situation.” The arguments for compliance mentioned in his example, each relate to a particular rule type:

Argument for compliance	Related rule type
being rewarded for doing so	Regulative
believe to be morally obligated to do so	Normative
conception of what reasonable others would do	Socio-cognitive

Table 2. examples of arguments for compliance and related rule type according to Scott (2008)

*Regulative:* Regulative aspects of institutions are recognized and underscored by all scholars, in the discipline of economics, because regulative aspects are considered to be the most determining features of institutions. Regulative aspects can have various forms and means of compliance, they can be coercive and restricting, but can also be enabling, and can offer positive incentives (Scott, 2008). The regulative rules include incentive structures, regulations, and governance systems.

*Socio-cognitive:* This rule type stresses the importance of a common framework of meanings which develops as a socially mediated construction. Features that feed this co-creation of common understanding are, for example, shared attitudes and common values (e.g., Hofstede, 1984), as well as shared problem definitions, belief systems, routines, and things that are taken for granted. Compliance occurs due to the comfort of belonging and doing what one is supposed to do, what others perceive to be the right thing, correct and sound. Not complying with socio-cognitive rules might bring the risk of losing connectedness, feeling less competent, or becoming disoriented (Scott, 2008).

*Normative:* A stable social order, according to scholars from the normative perspective, is based on shared norms and values. Normative systems are based on a logic of “appropriateness” and determine responsibilities, rights, duties, and roles. Roles in this sense are to be understood as: conceptions of appropriate goals and activities for particular individuals or specified social positions (Scott, 2008, p.64). Normative systems have a stabilising effect and can restrict the social behaviour of people, but can be empowering as well. Scholars in sociology argue that socialisation processes serve the internalisation of these rules into the values, norms, rights, responsibilities and expectations of people (Geels, 2004, p.904). The three types of rules are not only linked within regimes, but also between regimes (Geels, 2004).

In the study at hand, the concept of ‘rules’ is used, since these rules of Scott (1995) enable a clear distinction, and thereby a thorough analysis, of what causes stabilization in the regimes by distinguishing rule types.

## 2.2 STABILIZATION IN THE REGIMES

As explained in the introduction, stabilization can result from change-obstructing rules. This section explains that particular rules can have a strong stabilizing effect in a regime, or may even be change-obstructive.

In a stable dominant regime, groups of actors align with each other by means of rules, thereby contributing to the stability of existing systems (Geels, 2004). The mechanisms maintaining stability or dynamic stability are specified by Geels (2004, p.910) in relation to regime rules. Geels (2004) views rules and regimes as the deep grammar of socio-technical systems, providing stability by guiding perceptions and actions. Rules tend to be reproduced, and reproduction of rules favourable to the existing socio-technical system does contribute to its stability. These ‘rules’ include: institutional arrangements, regulations, contracts, cognitive regimes, core competences, and capabilities (Geels, 2004). The stability that Geels refers to, is not absolute, but a dynamic stability, in which innovation still occurs, but is of an incremental nature (no radical change). Other scholars discussing stabilizing mechanisms explain stability as resulting from a ‘dominant design’. The existence of a ‘dominant design’ is an important feature in studying innovation processes, since the 1970’s (Kemp et al, 1998,

referring to Abernathy & Utterback, 'Patterns of Industrial Innovation', 1978). They indicate that dominant designs and related dominant regimes bring about various stabilizing mechanisms which slow down the introduction of new, more sustainable, technologies (Kemp et al., 1998). Incumbent technologies have an advantage over new technologies, even if they are not necessarily better, because of increasing returns, when technologies are widely used and diffused (Klitkou, 2015). Various processes together result in stable incumbent regimes, favouring incremental rather than radical innovations (Klitkou, 2015). Unruh (2002) cites John Maynard Keynes: "The difficulty lies, not with the new ideas, but in escaping the old ones".

In line with Geels (2004), this study aims to understand stabilisation in dynamic developments, rather than inertia or complete stability (the latter are more linked with the lock-in concept, while the study at hand uses the regime rules as core concept). Dynamic stability is approached by Geels (2004) with the three types of rules of Scott. The dynamic nature of the three regimes under study, the concept of stabilizing mechanisms linked to the rules, is more applicable than the lock-in concept. The literature on lock-ins is nevertheless useful for it helps to explain developments in regimes, which in this study may not result in lock-ins, but in more dynamic stability. Geels (2004, p.910) proposed to explain stabilisation by three different kinds of rules, see table 2. The lock-in mechanisms of Unruh, which may be at play in a lesser extent, but still be relevant, since they illustrate the extreme stabilizing behaviour a rule can have, are therefore categorized per rule-type in the table below.

Three kinds of rules and related stabilizing mechanisms		
Cognitive rules	Normative rules	Regulative rules
Cumulative learning process, building upon existing knowledge. Investments in competences, skills and knowledge build up in time, radical changes would destroy investments. Shared believe in problem solving by existing system, fitting users' preferences. (Geels, 2004)	Mutual role perceptions stabilize networks. Ideas of proper behaviour, including which issues should and should <i>not</i> be raised. What one ought to talk about, or do research on, and what <i>not</i> . (Geels, 2004)	Technical standards or subsidies which favour existing technologies. Legally binding contracts. Government regulations structuring economic processes (Geels, 2004)
Organisational lock-ins: Routines, training, departmentalization, customer-supplier relations (Unruh, 2000; 2002)	Societal lock-ins: System socialization, adaptation of preferences, and expectations (Unruh, 2000; 2002)	Institutional lock-ins: Government policy intervention, legal frameworks, departments/ministries (Unruh, 2000; 2002)

Table 3. Three kinds of rules and related stabilizing mechanisms

In and among these three rule-sets, rules exist and interact, and their embeddedness may create a bottleneck for transitions in institutions (Scott, 2008). The study at hand abstracts the different types of rules, and where

relevant, reflects on the interlinkage of different rules. The relevance of these interlinkages was emphasised by Giddens (1984) especially explaining how 'regulative rules' need support from 'normative rules' for gaining legitimacy, and vice versa, for supporting normative rules with sanctioning power and or incentives (Giddens, 1984). Next to the interlinkage of normative and regulative rules. Suchman links legitimacy to shared socio-cognitive rules "Legitimacy is a generalized perception or assumption that the actions of an entity are desirable, proper, or appreciated within some socially constructed system of norms, values, beliefs, and definitions" Suchman (1995, 574). Scott (1995) relates legitimacy to the three types of rules by stating from an institutional perspective, legitimacy is a condition in which consonance is perceived with relevant rules and laws (regulative), normative support, and alignment with cultural cognitive frameworks. These three categories resemble the three types of rules of Scott.

This study aims to trace the dynamics that embody a stability, by analysing the existence of the three 'types of rules' of Scott (1995) and the stabilizing mechanism they cause in terms of Geels (2004).

### 2.3 EPISTEMIC CULTURES AND THE ROLE OF KNOWLEDGE

The regulative, normative, and socio-cognitive rules not only bring about stabilization, but also meaning making properties (Scott, 2008, p.57). This meaning making is an important feature of epistemic cultures as well, and is assessed in the regimes in the study at hand. The epistemic cultures will be used to analyse the data and trace potential relations between these cultures and stabilizing regime rules. This section gives an overview of distinct epistemic cultures typical for the regimes under study.

Knorr-Cetina (1999) describes epistemic cultures, as determining how we know what we know, shaped by historical coincidence, affinity, and necessity. The broader concept of epistemology not only refers to the nature of knowledge, but also to beliefs and questions around the justification of knowledge and beliefs, or, as Steup (1996) proposes, the question: "what makes justified beliefs justified?". Leeuwis (2004) describes knowledge as the basic means by which we understand and give meaning to the world around us. Wisdom, he says, is about the selection of appropriate knowledge in a given situation, the relevant schemes of interpretation, and the use of this in choosing whether and how to act (Leeuwis, 2004, p.94-95). Knowledge can be tacit (practical) and explicit (discursive). Explicit, or as Giddens (1984 p374) calls it, 'discursive' knowledge can partly be made explicit in language. It is a type of knowledge people know consciously and can write or talk about. Scientific knowledge, by definition, is explicit knowledge (because it can be written down, presented, or consciously studied). In farming, there is a lot of practical knowledge, according to Leeuwis (2004, p.97) many farmers *know* the right moment to sow or how to use a tractor on a particular soil type, even if they cannot explain exactly the underlying physical or natural principles in words.

While knowledge may seem to reduce ignorance, when studying the creation, diffusion, and use of knowledge more closely there is an important link between knowledge and ignorance (Leeuwis, 2004). In this respect, Leeuwis (2004) refers to the work of Winograd & Flores (1986) and Long (1987:5) explaining that different schools of thoughts and views give insights about reality, but also *exclude* a range of *other perspectives*. Wiskerke and Van der Ploeg (2004) cite Hobart (1993) to state that a regime always implies a specific distribution of knowledge and ignorance, dominated by the knowledge which serves the 'privileged way forward', while alternative knowledge stays in the shade or is not often consulted nor developed in the regime. Different groups and cultures have not only different knowledge and perceptions of the world, but also different ideas on how to make or validate knowledge (Leeuwis, 2004). With the help of Leeuwis, (2004, p.98-116), I will investigate the different epistemic cultures (theories of knowing) in the three regimes.

Various scholars (Leeuwis, 2004; Wiskerke & van der Ploeg, 2004; Stuiver et al., 2004; Scott, 2008; Hobart, 1993) emphasize the importance of farmer's knowledge in bringing about sustainable innovations in agriculture (while according to Leeuwis (2004 p.106), many natural scientists tend to believe that their knowledge is universal and generally applicable and therefore superior to farmers' knowledge). Stuiver et al. (2004) explain the importance of farmers' knowledge, as it is a valuable source for understanding ecosystems and the ability to transform them. They state that this has been overlooked for too long: *"the focus on the possibility of using and enhancing farmers' knowledge has remained hidden within the context of the prevailing dominant scientific knowledge system"* (Stuiver et al., 2004, p.95).

Leeuwis takes the stance that natural scientists should realize that all knowledge is contextual, even when the laboratory or scientific community are the context. Moreover, he underlines that scientific research is not neutral, but serves specific goals and interests; research conclusions are linked to the research questions: *"These questions and problem definitions, of course, are never neutral: they are asked and/or funded by specific stakeholders, for a specific reason, and in connection with specific goals and interests"* (Leeuwis, 2004, p.107). One stakeholder may be in a much better position to influence the research agenda compared to another stakeholder. This is an exemplary statement to show how the working of the three types of rules in relation to the epistemic cultures: *normative rules* are at play in setting the research agenda (Leeuwis calls them the goals and interests), this is regulated by the funding structure (*regulative rules*) and meanwhile the *socio-cognitive* rules safeguard these habits and take for granted the partnerships as the usual business. It is essential to question routines and regular patterns of thinking and acting, since they might impede change processes in institutions (Van Mierlo et al., 2010, p.2). Above all, these dominant patterns of thinking and acting hinder the processes of transforming new ideas into action in a variety of ways:

- *via anticipating external „given“ institutional constraints by project managers and participants;*
- *via project managers sticking to the classic roles of researcher and extension provider;*
- *via project managers anticipating and experiencing negative responses of potential participants; and*
- *via participating actors anticipating and experiencing negative responses from their organization or constituency."* (Van Mierlo et al., 2010, p.2).

Corcoran, Weakland & Wals (2017) highlight the interactive agency of the natural world with the human species. They underline the need to integrate this interaction again in Western ontology and epistemology. Especially in agriculture, this interactive agency of the natural world with the human species is evident, and this deserves a place in the education, sciences, policies and production practises related to agriculture. This study aims to uncover dominant patterns of thinking and acting in the three regimes (agriculture, science and vocational education) when it comes to knowledge creation, validation, diffusion and use.

## 2.4 ANALYTICAL FRAMEWORK

For an in-depth analysis of the research data, the analytical framework consists of two main concepts: The three Types of Rules of Scott (and their stabilizing effects on regimes) and the Epistemic cultures.

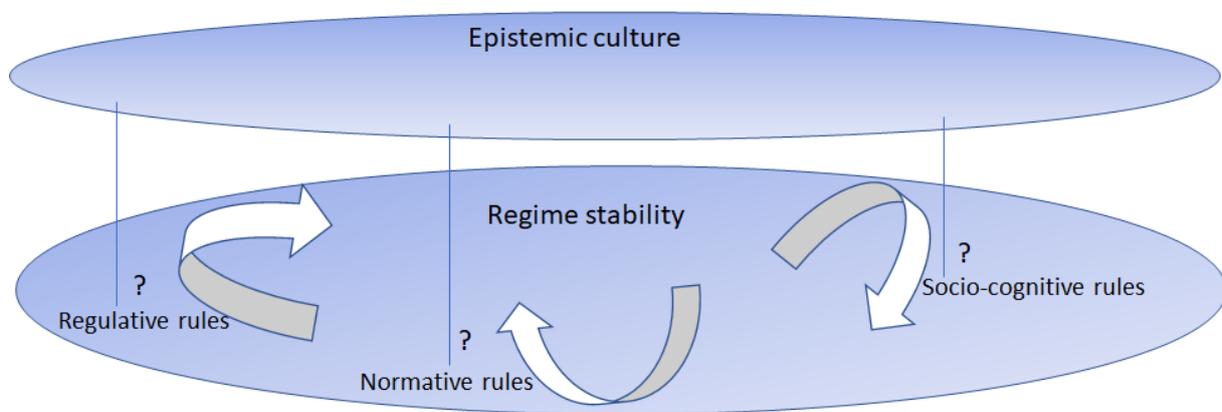


Figure 1 Analytical framework to study regime stability

The figure above presents the analytical frame per regime existing of the two conceptual layers: stabilizing rules and epistemic culture. This framework will be used to analyse each of the three regimes, the vocational education regime, the scientific regime and the agricultural production regime.

## 3. MATERIAL AND METHODS

In this section, first, the data collection is specified, including a description of the methods to obtain data, and materials used to study the creation, use, and diffusion of knowledge in agriculture, vocational education, and science. Secondly, I describe how the data is analysed, and thirdly, I recognize the limitations of this study.

### 3.1 DATA COLLECTION

To answer the research question, participatory research and semi-structured interviews with stakeholders from the different regimes were carried out, complemented with desk-research.

The selection of interviewees was based on the criteria that they were working on changes. Because they were most likely to have had confrontations at the edges of the regime, indicating the change-obstructing rules. For each regime at least one interviewee was selected who was not focused on making changes. The research sites were selected for the same reason, they were the places where actors came together with the objective to bring about changes. The research site for studying the agricultural production regime was the meetings of Natural Livestock Farming. In the case of the vocational education regime, these were meetings of the AOC consortium on sustainability and the teacher development team on sustainability. For the science regime, two events about the Future of Agriculture and a symposium on Resilience were the sites in which change obstructing rules were studied. Appendix IV provides a detailed list of interviewees and participatory research sites. The data collection was completed with desk research, to allow for triangulation (Bogdan & Biklen, 2006).

The interviews and observations focused on:

- actors perception of what change is desirable in the agricultural system,
- actors perceptions of what was hampering change processes at the moment and
- which knowledge or information was considered legitimate and useful in their own profession and in their interactions with other stakeholders.

### 3.2 DATA ANALYSIS

Findings were coded, sorted and analysed in Atlas.ti in two distinct phases. First, I coded the texts with codes representing elements of the three rule types of Scott, such as: belief systems, problem definition, bodies of knowledge, knowledge at farm level and regulations. Secondly, to create a more solid structure in my data, the output of Atlas.ti (labelled with codes) was sorted in the three distinct rule types for each of the three regimes. If a piece of text was explicitly referring to the interaction of regimes, I categorized it in a separate section, called after the interacting regimes. The overview resulting from the three types of rules in the three regimes, was read precisely, with the different kinds of stabilizing mechanism set out in table 3. in mind, to trace whether my own data included similar stabilizing rules. Finally data was analysed by creating an overview of co-occurrence of codes in Atlas.ti (Appendix IV). Where co-occurrence was high, I looked for the relation between the two codes.

For analysis of the epistemic cultures, an overview was created in Atlas.ti based on codes used in the first round of coding, such as 'knowledge in practice at farm', 'specialist/generalist' and 'bodies of knowledge/beliefs'. This overview was used to provide examples which indicate the features of the distinct epistemic cultures.

### 3.3 RESEARCH LIMITATIONS

It is important to recognize the role and bias of the researcher, since the content of the interviews are determined and controlled by the researcher herself. It is essential to view the interviews as examples of social interactions in which the interviewees create an interactive frame with the researcher. A consequence of this is

that the data from the interviews is influenced by certain normative expectations, and the end product of the conversation was made jointly by both the interviewer and the interviewee. My main bias is my critical view on Wageningen UR and her ties with unsustainable industries, this view results from several occasions: the mixed interests of the University, which I was informed about by University staff during my time in the central participation council of the WUR. As well as, for example, the fact that the Executive Board invited climate 'optimist' Matt Ridley as keynote speaker to open the academic year 2017-2018. Giving him such a stage to speak -with no opportunity for debate- was believed to be a controversial choice, as many scientists already counter argued the 'optimistic' statements by which he downplayed the severity of climate change (as referred to in an alarm-letter signed by 23 WUR scientists <sup>1</sup>). Nevertheless, I tried to not be too biased against Wageningen UR in general. The focus of this study is on stabilizing regimes, not on academic activism.

## 4. RESULTS

This chapter provides an overview of the distinct types of rules per regime, especially highlighting change-obstructing rules, and the resulting stabilizing mechanisms observed in the data. Per regime a section is added to summarize the most important rules and -if applicable- their interlinkages. Each regime section will end with a section which gives insight in the epistemic culture dominating the regime. In the conclusion I will address how these epistemic cultures connect with the stabilizing rules.

### 4.1 THE AGRICULTURAL PRODUCTION REGIME

#### NORMATIVE RULES IN THE AGRICULTURAL PRODUCTION REGIME

If it comes to change obstructing rules at the normative level in the agricultural production regime, farmers' perceptions of desired changes was discussed. As the head of the Foundation for Natural Livestock Farming (who worked as a veterinarian for over 30 years) told me, farmers often perceive the term 'sustainable agriculture' as threatening (this was confirmed by several actors in the participatory research). She advised me to avoid using this term and speak of natural- or nature inclusive agriculture instead. Interviewees explained me that this negative connotation of 'sustainability' results from the fact that this term has been used by policymakers to impose restrictions and regulations on farmers. Using this term in efforts to make changes in collaboration with farmers, leads to resistance and thereby obstructs changes (as the observations in this study confirm).

The interviewed farmers, who started with nature inclusive agriculture in the Netherlands, often focus on creating habitats for pasture-birds. According to the interviewed professor Nature Inclusive Agriculture there is subsidy available for this, but those farmers often feel that they are looked down upon by surrounding farmers in the current regime: *"they find support from each other, while other colleagues often look down at them like "those meadow bird farmers" and they perceive that network to be really important to indicate the urgency to*

---

<sup>1</sup> <https://centreforspaceplacesociety.files.wordpress.com/2017/08/letter-ridley-opening-academic-year-2017-2018.pdf>

*make changes*". This negative reaction of colleague farmers points out another normative rule which is not favourable for changes toward Nature Inclusive Agriculture.

The above mentioned finding seems to oppose the claim made by Bouma and Marijnissen (2008) that over eighty percent of the farmers would like to farm more nature friendly and almost half of the farmers strive to make the transition to sustainable agriculture within ten years, but they feel challenged by a lack of clarity in agricultural policies. This claim was discussed in the Natural Livestock Farming WhatsApp group. One of the responses was that this is based on 2200 farmers who responded to a questionnaire, while 12800 did not respond. Those 2200 might have wanted to show their good intentions and may not be representative for all other farmers. Another reaction from a young dairy farmer was, although she believes the majority of livestock farmers would like to work more sustainably and is working toward this, *"it may seem interesting for individual farmers to enter this niche market, like the question is posed 'what will you do at your farm?' but for the sector as a whole this is not a solutions, because where will the bulk production go?"*. She adds *"we have to stay realistic especially about the speed of the transition at farms and the risk that mass production will move to less sustainable places, eventually, it really needs to improve, and not only be 'not in my backyard'"*. This normative rule indicates a farmers consideration of the side effects of a rapid transition in Dutch agriculture in the context of the globalized food market.

Interviewees (including people who worked for Wageningen UR) say that Wageningen University and Research Centre (WUR) used to have farmers as their target group; they worked for farmers, but this has shifted along with the funding of the research, and currently WUR is targeting agribusiness and industrial parties who are in a position to fund research. This influences the selection criteria for scientists regarding which research questions they work on and thereby which change they support, facilitate, or enable. Meanwhile, it makes farmers skeptical about the goodwill of the scientific community towards them. Both points create stabilizing mechanisms, in the sense that WUR keeps working for dominant regime actors, who have no interest in radical change, and farmers do not address their practical problems to the WUR. These developments obstruct the collaborations that would potentially contribute to sustainable solutions for the agricultural sector.

While talking with my interviewees about sustainable agriculture (throughout this research) it was often painfully clear that farmers felt the term 'sustainable agriculture' was favoured by consumers, and civil society, who did –according to the farmers- not even know what agriculture is like in practice. *"The blame is often put on the farmer: 'the farmer is doing wrong and does not have meadow birds anymore and he does it badly', but in many cases he is also stuck in his own situation. Yes, he is also limited within his company by what the possibilities are, so it is always very easy to say 'you do it wrong' or 'it has to be completely different', but you have to come up with workable solutions so that a farmer can also earn a good income, and that is a bit of a challenge, because there are reasons why farmers have always become bigger: the milk price is not very high, the margin is not big, so they do not seek specialization but instead grow bigger and bigger, they go more and more one way, and that diversity then disappears a bit, so that is a shame"*. This interviewee points to the problem of disconnectedness between farmers and the other groups of actors in society and the blame that is

put on the farmers. The International Panel of Experts on Sustainable Food Systems reported this as a global trend: *“consumers have become increasingly disconnected and disengaged from food systems. As a result, the fact that food choices have implications for farming systems has become less obvious and less important in the hierarchy of daily concerns.”* (IPES-Food, 2016).

---

#### REGULATIVE RULES IN THE AGRICULTURAL REGIME

Regarding the regulative rules, interviewees mostly pointed out that regulations were setting generalized standards, rules, and sanctions on non-generalizable factors of running a farm (since each farm and each plot of land is different). Interviewees referred to the mandatory injection of manure into the soils since 1994<sup>2</sup>. A rule generally applied to all farmers in The Netherlands, faced resistance for its damaging effect at the local level, because the injection damages soil life, structure, and soil organisms. Farmers have been openly contesting the mandatory injection regulation from the very beginning. One of the interviewees told me: *“Farmers on peat soils, said ‘are you out of your mind? I will not work the soil with such heavy machinery to inject the slurry, that would completely destroy the soil!’ There have been court cases on this, but still the slurry had to be injected”*. It took over 20 years before the government came back to this regulation and made exceptions to it (Foodlog, 2008. 1 & 2). A former dairy farmer, now broker in agricultural real estate, who visits many farms, explains the striking results of the manure-injection regulations and a farmers’ perception of manure as a ‘good product’: *“If your animals eat healthy, the slurry is a good product, especially in organic agriculture, with pain in their hearts the farmers used the slurry-injection-machine which turned their soils completely upside down, ‘I was working to improve this soil for so many years; now the soil-life is completely damaged.”* One of the interviewees (who worked in the management of Wageningen UR, currently director of a cluster of AOCs) said that such regulations are made by people who stand too far from agricultural practice. The problem he underlined is the divide between agricultural policy-makers, often educated at Wageningen University, and farmers, often educated at AOCs (Agricultural Schools for Vocational Education). The findings indicate that the regulations in agriculture are not always in line with what farmers believe to be good at their farms. They have in common that they are too generalized, lack adjustment to different contexts, natural and social environments, and do not consider the complexity and context at farm level (mentioned by several interviewees). The stabilizing mechanism at work here is the mechanism of policy making based on assumptions which are far from the farmers’ practice, which leads to resistance

As mentioned in the section above (on the normative rule type), veterinarians are more reluctant to use natural alternatives instead of pharmaceutical ones. This can be linked to the findings in the regulative rule type: Regulations on the health claims of natural products have made the promotion of these products, as substitutes for, or in addition to, pharmaceutical medicines harder. As mentioned by a retailer of farm equipment and animal feed, said: *“There is an obstacle in the regulations for natural products, as it is not allowed to make claims on packaging about the beneficial effects (until there is abundant scientific evidence),*

---

<sup>2</sup> This regulations on manure injection, mandatory in the Netherlands only, facilitated an exception for farmers in the Netherlands from the EU criteria for ammonia and methane emission per acre.

*and besides, there still is a lot of resistance on the part of the veterinarians".* Another veterinarian added that there were no corporate incentives (for industrial companies), no business model behind the promotion of natural treatments, and that was why attention for it rapidly decreased, also in academia and, which in turn led to lack of scientific evidence, which makes it again harder to legitimize.

A special professor of Nature Inclusive Agriculture emphasised that currently, measures related to Nature Inclusive Agriculture are all optional and there is no regulative pressure. This could enhance the stability that exists in the agricultural production regime, he suggests, because farmers who do not prioritize a more natural farming approach do not encounter sanctions to change their practices either. Moreover, he expressed his disappointment in the European Commission, which is not using its sanctioning power: *"When the Netherlands is not doing enough to protect endangered bird-species (like the Grutto), the Dutch farmers still receive certain privileges, like exemptions from rules on how much manure can be produced (derogation). Putting efforts in Nature Inclusive Agriculture is too non-binding at the moment."*

Several interviewees explained how some regulations intended to make agricultural more environmental and animal friendly, did not operate as they meant to operate. Especially when farmers disagree with the implementation of the regulations, or they simply do not have the financial means to implement the required changes, they will deal with the requirements in their own inventive ways. Likewise, two interviewees (a researcher and a farmer) talked about the acres per cow a dairy farmer needs to have: The reality was that on paper the farmers might have enough acres of land, but this land could be at the other side of the country, so it could not be used for the cows to graze on. The stabilizing mechanism here is that the targeted change from policies and regulations, including the changes aiming at NIA, will not be thoroughly achieved because of the normative rules of farmers who are not aligned with the regulative rules.

An interviewee working for Nature Inclusive Agriculture gave the example of how certain areas assigned to be open-field landscapes, formed an obstacle for starting permaculture, because in permaculture trees have a very important role, but there were no trees allowed in these areas. *"In such cases I do not believe that the regulations serve as they were intended. Where farmers intend to take good initiatives, they are punished for it instead. I believe the government should have a more facilitating role and allow more space to experiment with alternatives like permaculture."* Here the stabilizing mechanism comes from the regulative rules, forming an obstacle for farmers' initiatives aiming at Nature Inclusive Agriculture.

An interviewed researcher from Wageningen UR told me that when farmers want to contribute to nature management and biodiversity, this is accompanied by lower yields of grass, and applying for compensation for this is only possible in the designated areas. The grass production is 30% lower on herb-rich grassland, only reaching about 7-8 tons per acre (instead of 12 tons) and farmers think this means a loss of income, because they can milk less. They want to see this compensated, which is possible through agrarian nature management agreements, but only if your farm is located in an appointed area. However, this interviewee also adds: herb-rich grasslands can be profitable in several ways, they keep the cows more healthy, because they contain more minerals and trace elements and reduce the veterinarian-costs and the rumen of the cow handles it differently

and then absorbs more of it, so milk production stays the same. “Most farmers do not know this”, he said, and this has to be taught again, how to integrate it and the added value of this for the cows. This example shows the importance of regulative rules to stimulate farmers to change practices and thereby bring back knowledge, since farmers hold the shared belief that herb-rich grasslands give lower production, not taking into their calculations the benefits of herb-rich grasslands.

---

#### SOCIO-COGNITIVE RULES IN THE AGRICULTURAL REGIME

The socio-cognitive type of rules includes the rules that make people take certain things for granted and find other things outrageous. Socio-cognitive rules are of high importance in the agricultural regime, and the interviews and observations underlined that among farmers in decision making it is very important what ‘reasonable others’ would do. As mentioned in the section above on the normative rules, a support network is very important for farmers. Farmers learn a lot from each other and generate tacit knowledge from their practices and observations at the farms from generation to generation. Some practical knowledge which is becoming relevant again, has disappeared from many farms throughout the era of intensification. As an AOC teacher told me, the knowledge of the management of grazing has disappeared on many farms over the last two generations who kept their cows inside.

Farmers are skeptical about the efforts of Wageningen UR to help develop knowledge for sustainable agriculture. Several interviewees also mentioned that the farmers feel neglected by scientists. Two interviewees working for Wageningen UR confirmed that their chair group does not often organize conferences or network opportunities together with farmers, rather with only their business partners, with whom they also compose the research agenda and apply for fundings. This was the case at the Resilience symposium 2017 organised by the Animal Science group, as one of the organisers told me (Van der Peet, 2017 –informal- WUR Resilience Symposium, 2017). Erik Toussaint from the Plant Science Group confirmed that the same was true for events on Plant sciences in Wageningen, as they hardly ever invited farmers to join. This causes a stabilizing effect, if we assume that a fast transition to more NIA requires collaboration between scientists and farmers. It can even unnecessarily slow down transitions indirectly, via policies that will be based on scientific research, when in both the research and the policies farmers’ knowledge is neglected. Which, according to my interviewees, happened repeatedly.

During a discussion with farmers, scientists, and other interested actors (after the screening of the documentary ‘The Mystery of the Milking Robot’), multiple dairy farmers expressed that they were wondering what the researchers at Wageningen UR were doing, as they did not feel that it served them. One farmer said that farmers have no neutral party to address their questions to. When discussing this with a scientist from the Animal Science Group, he replied that they do collaborate with innovative farmers in several research projects. I asked if they selected specifically the ‘innovative’ farmers, and he confirmed that this is the most interesting group for their research. This could explain/confirm the perception of the ‘conventional’ farmers that Wageningen researchers were not serving them or collaborating with them. As one trainer and author of educational material on livestock farming suggested, sometime farmers first discover something and then the

scientists follow. Collaboration with innovative farmers may be inspiring and useful for scientists, but it is different from researching those problems that farmers are confronted with. This selectivity on the side of the scientists can lead to stabilizing mechanisms in two ways: the research agenda does not address the problems that farmers have to handle before being able to make changes at their farm, and this can worsen the skeptical view farmers have of scientists and thereby hamper their communication and potential collaboration for change.

The interviews and participatory research in this study, mostly in the Nature Livestock Farming group, pointed out that for Dutch dairy farmers their farm size is a bottleneck for applying natural medicines and natural treatments, as they learned about during their study group. One veterinarian said farmers still use a lot of natural products, but there is little knowledge about it, and it has moved to the background. The head of the NLF emphasised that an important aim of her exchange programme with India and Uganda is to prevent them from making the same mistakes as we did in the Netherlands while developing our agricultural system. The 'mistakes' she spoke about mostly concerned input-dependency and farm size, the growth of these two aspects drove farmers in the Netherlands away from the Natural farming approach and diminished their knowledge of natural farming. One of my interviewees (a veterinarian, advisor, and author of educational material) explained how the role of the majority of farmers in the Netherlands has changed over time: "farmers became more and more managers, so you see that they transcend the level of operational work, you see the shift of the worker, the operational things of 'how do I do it? how should I organize the work? what exactly is it about ' there is a clear shift to management, so questions like 'How should we design processes?' and always analysing management processes, dealing with employees, labour efficiency, things like that have become much more important. Methods and protocols are of course more and more important, and in the past those farmers did it all themselves or with family members, so it was not considered so important that everyone did that in a standard way". This focus on technical artefacts and techno-fixes, is also observed in science and policy making (De Nooy-van Tol, 2013 p.213 & Leeuwis, 2004).

#### SUMMARY OF THE RULES IN THIS REGIME

At large, farmers in this study indicated that they would prefer to run their farm in a more natural way (normative rules), but were mostly restricted by a lack of resources for making this transition. The lack of clarity about government incentives for change (regulative rules) was mentioned to have a stabilizing effect on the regime. Moreover, the lack of consumers' awareness and therefore their willingness to pay more for more nature-inclusive food production was mentioned to have a stabilizing effect on the production regime. Direct contact between farmers and scientists, and their collaboration in problem solving, has decreased (socio-cognitive), due to incentive structures that rather stimulated partnerships between scientists and more resourceful -often industrial- companies instead (regulative rules), which now are so embedded in the habits and routines of the science community that they hardly organise conferences or events with farmers anymore (socio-cognitive). Farmers expressed that, according to them, scientists (at Wageningen UR and the University of Utrecht) do not really focus on solving the problems of the farmers (normative rules), and a certain distrust

was expressed. The two stabilizing effects here are: first, the lack of an effective incentive structure to enable change, and second, farmers' distrust in scientists might have a stabilizing effect on the farmers' regime. Yet, this second mechanism only exists under the assumption that collaboration between scientists and farmers would bring about the desired changes more rapidly, which is not proven in the study at hand.

#### EPISTEMIC CULTURE(S) IN THE FARMERS' REGIME

In line with Leeuwis (2004), this study confirms that farmers' epistemology largely consists of practical experience, intuition, comparing farms, discussions with colleagues, and, additionally, nowadays also online, for example in fora and groups like the NLF WhatsApp group, used for sharing news, problems and advice.

At the conference on Natural Livestock Farming (2018) farmers and veterinarians discussed the priorities for moving forward with natural livestock farming. Farmers proposed to start experimenting, and based on this, collect 'good practices' while some veterinarians and one researcher preferred to make a research plan that could lead to a scientific publication. One retailer in farm equipment (including animal feed and medicines) and three veterinarians who are in the Natural Livestock Farming community told me that most veterinarians are skeptical about natural treatments for cows and in their studies at the Faculty of Veterinary Science (University of Utrecht), knowledge on this was hardly addressed. They also referred to the role of the University of Utrecht, where the research agenda and the curriculum are more focused on the use of medicines instead of natural cures or ways of keeping animals healthy. Suggestions were made that this has to do with the financial model which works as a stabilising mechanism on the veterinarians and the veterinary faculty, in which a major funder is the pharmaceutical industry (NLF, 2017). One dairy farmer said *"That is the problem, it's all the time about scientific, this, that, but maybe that is not necessary, maybe we can just share what works well for one farmer or what one has experimented with"*. In contrast, a researcher of the Louis Bolk Institute said *"we have to come up with a scientific publication soon, to back-up our ideas"*. The dairy farmer recalled, *"during the workshop, veterinarians started talking about making it scientific again.. 10 years have passed now."* Katrien, director of Natural Livestock Farming stated that it needs to be done both ways.

This difference in beliefs about what is the best way to proceed with knowledge creation and diffusion was confirmed in other interactions as well. Veterinarians tended to be closer to the scientific epistemic culture, while farmers had their own epistemic culture, building on practical knowledge and expertise. Exemplary for this difference is what a retailer in the agricultural sector (Manager of an Agro farm shop) told me, namely that the demand for herbs and natural treatments in dairy farming is growing among farmers, but that their veterinarians are often more reluctant, and therefore not all farmers inform their vets about the use of those alternative products. Several interviewees spoke of books about the herbal medicine which they knew of, but even if it was present in their family, they said it was not often talked about or consulted. One veterinarian stated, *"before the invention of penicillin, veterinary science was all about herbs and other natural treatments, but since the industrialisation this knowledge has been neglected"*

As underlined during a focus group discussion with farmers, nowadays the tacit knowledge of many dairy farmers no longer covers everything they have at their farm, new systems and technological artefacts are introduced, like milking robots, which are outside of the scope of knowledge and expertise of the farmers. The focus group discussion also made clear how this puts the farmers in vulnerable positions in which they depend on external experts. In their profession, farmers make use of various types of knowledge, including tacit knowledge and believes. One example given by multiple interviewees (including three farmers) in this study was the influence of the earth's magnetic fields on cows. When cows show unusual behaviour, e.g. one farmer's cows did not come to the feed fence anymore, this was solved by installing a so called 'source corrector'. If something is effective for a colleague farmer, regardless of any underlying scientific evidence, farmers will tend to try it as well according to an agricultural real-estate broker and former farmer: *"these source correctors are not cheap at all, farmers are not crazy, they know it functions well before they buy one. This is not a particular type of farmers, you see this at many conventional farms. I do not know how it works, the farmers do not know it, but they couldn't care less, as long as it solves the problem and it does for many farmers. This is a practical example from my experience, I had it at my farm as well"*. Later at a field trip a conventional dairy-farmworker also elaborated on the sensitivity of cows to magnetic fields, saying they are much more sensitive for magnetic fields compared to people. However, in the audience after the casting of *The Mystery of the Milk-robot*, there were also skeptical reactions from farmers they said it was going a bit too far into the spiritual world. One farmer in turn reacted to them by saying *"where else can they go? Where can they find help? also not in Wageningen anymore"*. Neither do dairy farmers contact the Veterinary Faculty of The Utrecht University, according to Jan Hulsen *"if anyone has a question from the farm practice, no one would call the faculty"*.

Several interviewees and farmers in the focus group discussion pointed at the lack of people with general knowledge of farming who could assess problems and give neutral advice. They said there is no one with general knowledge on farming who drives around visiting farms to spot the problems that are present. The advisors, the few actors who visit farms are giving biased advice, they are employed by animal-feed suppliers or suppliers of pesticides, according to two interviewees and as confirmed by participants in the discussion.

With regard to the role of knowledge and expertise, the head of the Foundation for Natural Livestock Farming (NLF) told me that one of the most important messages she wanted to bring across, from the Netherlands to farmers in India and Africa, was: do not make the same mistakes as we did in The Netherlands while developing our livestock sector. As she explained her NLF exchange program: *"Farmers from different parts of the world can see what lessons can be learned after 60 years of intensification and specialization of dairy farming in the Netherlands and what is relevant for countries like theirs. So, they do not have to repeat our story and repeat certain mistakes, but they can learn immediately"*. When discussing the role of different types of knowledge, she said: *"The problems that are now in agriculture, are far too big to be solved by Western science alone. You need different knowledge inputs. Both from western science but also from other sciences, like in India the Ayurvedic science, and a lot of local knowledge from farmers."*

## 4.2 THE SCIENCE REGIME

### NORMATIVE RULES IN THE SCIENCE REGIME

Normative rules were identified by several interviewees when discussing the agenda-setting processes of research at Wageningen UR and the current incentive structure, for example in the Tenure Track. These structures create a bias toward certain types of research, which not everyone considers to be the most appropriate or desirable. Similar issues were also mentioned in the context of Utrecht University. Moreover, multiple interviewees indicated that the board (assisted by the corporate communication department) has strict ideas about how, and on which topics, researchers from Wageningen UR may communicate with the public. Normative rules also include shared perceptions of the purpose of a particular organisation. With regard to this purpose, the board appears to have a bias (as observed in its strategic agendas) toward profiling the university in a way that attracts well-resourced clients from the dominant agro-industrial regime. This bias may slow down or even obstruct the transition away from the dominant regime in agriculture.

In relation to these normative rules, and in questioning “what is the university for?”, several interviewees (including researchers from Wageningen UR) criticized the influence of companies on the research agenda of WUR. One interviewee stated: “Those companies will simply not benefit from alternatives that replace medicines, for example, or from solutions that make medicines less necessary; this is not in their interests.” Another interviewee (a veterinary trainer and author of educational materials on animal health) suggested that the University of Utrecht also has a bias in its research agenda, arguing that the Faculty of Veterinary Sciences focuses on treating rather than preventing diseases or injuries, and pays little attention to maintaining animal health. Former students of this faculty confirmed this observation, and some of them suggested that this bias serves the interests of research partners.

One WUR researcher mentioned that many of his colleagues did not dare to speak to the media, especially on controversial topics. He recounted being invited to speak on a television program, and the producers told him that none of the researchers they had contacted previously wanted to participate, even though the topic fell more directly within their fields of expertise than his own. The interviewed researcher stated that they were too afraid. Subsequently, he was asked by the Executive Board of WUR who had authorized him to appear on television. He replied, “Myself; I spoke on my own behalf,” after which he was instructed to always inform the Executive Board in advance in the future.

The situations described above exemplify normative rules within the science regime, by illustrating what people believe they ought to do. These rules can have a stabilizing effect, as they tend to restrict research agendas to what is considered acceptable within the current regime. However, radical change requires research on divergent and unconventional topics, which do not necessarily serve the interests of the established partners of the existing science regime.

This section reflects on regulative rules in the science regime. The findings from interviews and participatory research are complemented with results from desk research. Desk research indicates that many universities in the Western world have encountered similar barriers to change related to regulative rules over the past decades (Muscio et al., 2013; IPES-Food, 2016). These change-obstructing regulative rules in the science regime largely result from budget cuts in government funding over the last 30 years, which have constrained higher education and agricultural research budgets and increased reliance on private funding (Muscio et al., 2013). This financial shift leads researchers to follow the agendas set by private-sector funders (IPES-Food, 2016), many of whom would face competitive disadvantages if radical change were pursued. The results from the present study are illustrative of these developments, which tend to obstruct radical change.

Formal documents of institutions can be seen as the embodiment of many regulative rules of an institution (and often also reflect underlying normative rules). The strategic plan of Wageningen UR for 2015–2018 opens by underlining the importance of the “Golden Triangle” in facilitating the development of agri-food and bio-based expertise (Wageningen UR, 2015). By this term, the executive board of the university refers to the collaboration between government, business, universities, and research institutes. The Strategic Plan of WUR (2015, p. 13) emphasises the importance of being market-oriented in order to maintain revenues: “we are becoming even more proactive about seeking new markets and acquiring clients and funding.” Business is explicitly identified as an important stakeholder in this strategic plan. It states that Wageningen UR aims to strengthen synergy between the components of what it calls “One Wageningen”, in order to present the organisation as having a clearly defined profile: “so that we are perceived internally and externally as a single, coherent organisation” (idem, p. 21). When outlining plans to improve ties with prominent partners (p. 21), many types of partners are listed, yet farmers are notably not mentioned.

Collaboration between Wageningen UR and companies goes beyond jointly attracting research funding; several professors at WUR are fully financed by companies, including Unilever, Danone, Nutreco, FrieslandCampina, BASF, and Philips (Wageningen UR, 2018). At the same time, the scientific research conducted at Wageningen UR informs and underpins government policy and legislation in this domain (Wageningen UR, 2015, p. 42).

In the context of this relationship between WUR and government policy, an interviewed agricultural policy expert working for an NGO emphasised that agricultural policy and research continue to focus predominantly on techno-fixes, rather than on developing a deeper understanding of ecological processes at the farm level. He stated: “Wageningen UR is dominated by agro-industrial interests; that is what WUR is known for. Although there are scholars in agro-ecology, these streams are less influential. It does not surprise me that WUR is not a pioneer in agro-ecology. They do work on sustainability, but very much from above, starting with science and presenting technology as the golden bullet.” This interviewee further argued that WUR, and other Western research institutes, pay little attention to “food sovereignty and farmers’ independence and autonomy.” He maintained that neglecting these issues while emphasising techno-fix approaches is less sustainable from a

socio-economic perspective. According to him, the stabilising effect of the science regime at WUR is caused by the dominance of agro-industrial interests and reinforced by a technocratic approach to sustainability.

With regard to regulative rules, the results of this study suggest that only a small share of the financial resources of Wageningen UR (WUR) is allocated to research in the direction of Nature-Inclusive Agriculture. Two WUR researchers who conduct research on natural approaches to agriculture both stated that they were the only researchers in their respective departments working on this topic. Both indicated that the governance structure, characterised by project-based funding, has substantially reduced the number of freely assignable working hours. One of them explained that he previously had 500 freely assignable hours per year, which was reduced to 100 hours per year, while the other stated that 1,500 hours had to be accounted for within project budgets. Both researchers reported dedicating their spare time to work on natural approaches to agriculture.

The organic agriculture researcher was often invited to speak, for example at an AOC or on farms where students would visit. However, if he had to invoice these activities, the costs would easily amount to €750 for half a day, which AOCs and farmers could not afford. He therefore frequently accepted these invitations nonetheless, took a day off, and participated without pay. The other WUR researcher stated that she could not attend an event in Arnhem—bringing together many farmers and other stakeholders—to discuss the future of dairy farming, because she could not allocate these hours to any funded project. She added that she nevertheless participated in several relevant meetings with farmers that year in her own time.

All interviewees from the science regime pointed to the pressure to publish in scientific journals, resulting from a regulative rule in the science regime: career advancement and promotion require a minimum number of publications in peer-reviewed journals. Two interviewees indicated that this publication pressure increased the distance between farmers and scientists. One explained: “The emphasis on writing for scientific journals has increased, and what is relevant for farmers has become less of a priority. Scientists write for scientific journals; whether anyone actually reads them does not matter.” Throughout this study, no formal incentive structures were identified that promote scientists’ cooperation with farmers, nor were many opportunities found for direct communication with farmers. One interviewed WUR researcher stated that this situation has changed over the past two decades; previously, direct communication occurred through farmers’ magazines and journals. Publications by WUR researchers were standard components of these magazines, and the articles included telephone numbers, allowing farmers to contact researchers directly. According to this interviewee, the university board later decided that the corporate communication department should write the articles instead of the researchers themselves, and researchers’ phone numbers were subsequently removed.

One regulative rule within the science regime had particularly direct implications for an interviewee from Wageningen UR. Quoting a colleague, he explained: “Everything first has to go to the ministry three months before publication—every article and every report.” Although the interviewee initially did not comply with this rule, his colleague insisted that it was mandatory, and he eventually submitted his report (on animal feed concentrates) to the ministry. He recounted: “There was a sentence stating, ‘on these farms we did not

measure the use of homeopathic treatments,’ and they suggested replacing it with another sentence. I said, ‘that sentence is not correct,’ and then they responded, ‘well, then the report will not be published.’”

Moreover, he stated that one of his colleagues withdrew a strong research proposal, because he believed it would not be permitted to conduct research on energetic fields and cows. This assumption was based on the fierce reaction of the Executive Board and mainstream media to earlier research on energetic fields in cows, which resulted in a newspaper headline stating: “For magical dwarfs, call Wageningen.” The former head of the Executive Board, Aalt Dijkhuizen, reportedly called the researcher’s director on a Sunday morning to demand justification. The researcher subsequently had to reassure his director, explaining that there was a proper, scientifically sound research plan and that there was nothing ‘unscientific’ about the study.

---

#### SOCIO-COGNITIVE RULES IN THE SCIENCE REGIME

This section discusses examples of socio-cognitive rules (e.g. habits, assumptions, and taken-for-granted beliefs) related to the science regime and examines how these rules result in stabilising mechanisms, thereby reflecting the existing frames of meaning-making within the regime.

One of the interviewees specifically addressed the differences in lifeworlds and frames of meaning-making between scientists and more practice-oriented farmers, as well as AOC employees and students. This interviewee, a former professor and manager at Wageningen UR’s Animal Science Group and currently an AOC director, stated that there is insufficient direct contact between WUR professors and people in the field who are engaged in practical work. He remarked: “That could be much stronger in Wageningen, to make sure that all those university teachers, who are now trapped in the Tenure Track, would get much more time to, let’s say, take a walk with a forest ranger, visit a livestock farmer, and be influenced by what those people can tell them.”

He not only pointed to the lack of contact between scientists and field-based professionals, but also highlighted how little university staff know about developments at AOCs, and how little effort is made to inform students about these contexts, even though those students will later have to work with former AOC students in their professional careers. To explain how this division emerged and how it obstructs change, he stated: “I have to refer to efficiency thinking at both the AOCs and Wageningen University. The AOCs operate within a tight financial framework, and the university has the Tenure Track, publication pressure, and rankings. This does not contribute to doing things differently.” He continued: “That is one part of the problem; the other part is that they operate in two different worlds, which are largely unknown to each other.”

Several interviewees suggested that the anticipation of a ‘privileged pathway forward’ within the science regime shapes research agendas. One Wageningen researcher stated: “The majority here in Wageningen is focused on optimising milk production at the lowest possible cost, including through pest control and robotisation; most Wageningen research is based on this logic.”

In the selection of research partners, both socio-cognitive and regulative rules appear to play a role. An illustrative example was provided by an organiser of a symposium at the Animal Science Group, who explained: “We mainly invited partners with whom we can jointly formulate a research agenda and who are able to co-fund the research.” When asked whether farmers were also invited, he responded: “If farmer cooperatives participate in networking events at WUR, they usually do so through their corporate or business branch rather than their farmers’ branch.”

Some examples illustrate socio-cognitive rules entangled with normative rules in the science regime, shaping perceptions of what is considered acceptable or unacceptable research. One interviewee who worked at Wageningen UR for over 30 years explained the strong domination of normative ideas. He described how he wanted to conduct a study that could lead to a reduction in the use of antibiotics, by changing the injection site for udder infections—from the neck to the udder itself. Reflecting on the reactions to this proposal, he stated: “You were considered crazy if you even doubted this. I did some research, but you were still seen as crazy for doing it, because it simply could not be done. You were almost a joke for even bringing it up.”

Similarly, a former Wageningen UR student, now an agricultural real-estate broker, spoke about researchers in Wageningen whom he considered to be true pioneers, far ahead of their time in terms of insights. He explained: “As soon as they went a bit too much off-road, toward alternative agriculture, many doors closed for them.” According to him, their insights were later shown to be highly valuable and were only accepted decades later. He gave the example of a researcher who was already discussing circular agriculture in the 1990s. “Those people were easily labelled ‘crazy’; they were ignored and politely sidelined, even though they were the ones who actually visited farmers and had extensive networks.”

Moreover, this interviewee argued that certain topics are systematically neglected by WUR scientists, particularly those that appear to lack a conventional scientific foundation, such as energetic fields on dairy farms, despite their perceived relevance for farmers. He expressed the view that researchers too readily conclude that such phenomena are not researchable and therefore do not attempt to investigate them: “Researchers say they cannot measure it, but in that case I think they could at least try. If the conclusion is that it is not measurable, that is fine, but not researching it at all is a missed opportunity.”

Another interviewee referred to a normative situation at Utrecht University, stating that if one attempted to reserve a room to discuss homeopathy, the request would be denied. Furthermore, he claimed that all veterinarians received a formal letter warning that their membership in the Society for Veterinary Sciences would be terminated if they worked with homeopathy. This occurred in the 1990s; according to the interviewee, the situation may have improved somewhat since then, but veterinarians are still not permitted to use medicines that are not officially registered. Registering a new remedy requires extensive scientific evidence, yet if no funding is available to conduct the necessary research, the remedy will not be registered, and “it simply dies out,” as he put it.

During the discussion following the screening of *Mystery of the Milk Robot*, farmers expressed frustration about the lack of support they receive from Wageningen scientists. One dairy farmer described a conflict with a company regarding the service contract of his milking robot and particularly missed the presence of a neutral expert during a court case. He stated: “When the milking robot was not functioning properly, the supplier and service company stopped responding—there was no one home anymore. When I brought this to court, the judge said, ‘Well, I do not understand that, so we will not talk about that.’ Then I think: where is the expertise? Isn’t there an expert in Wageningen who can explain what is going on? You cannot expect a judge to understand all this.” When the techno-fix fails to provide solutions in the complex reality of farming, WUR scientists are perceived as absent in supporting farmers.

Finally, several reports and policy letters emphasise the lack of research on nature-inclusive agriculture and agro-ecology (IPES, 2016; Directie Natuur en Biodiversiteit, Kamerbrief 10 juli 2017, *Betreft Natuurinclusieve Landbouw*). Agricultural research and education have largely developed in silos, failing to account for the complex interactions between the natural and societal dimensions of food systems (Francis & Campbell, 2003).

#### SUMMARY OF THE RULES IN THIS REGIME

With regard to attention for nature-inclusive agriculture in the science regime, the findings of this study underline that formal incentive mechanisms encourage the continuation of contract research for actors within the dominant regime (regulative rules). Such incentives are evident in the agenda-setting processes of Utrecht University’s Faculty of Veterinary Medicine and Wageningen UR. In the case of Utrecht University, this primarily involves a bias toward pharmaceutical research rather than preventive animal health research. Interviewees, including veterinarians, indicated that there is greater financial gain in developing medicines than in maintaining animal health, and it was suggested that veterinarians have therefore become accustomed to directing their attention toward curative approaches (socio-cognitive rules).

At Wageningen UR, interviewees mainly referred to partnerships and contract research with agro-industrial companies, which similarly shape research priorities (socio-cognitive rules). Farmers’ perceptions that they have little influence at Wageningen UR align with the accounts of two WUR staff members, who stated that symposia and conferences tend to prioritise partners who can potentially co-fund research, while farmers are rarely invited (both socio-cognitive and regulative rules).

As a result, certain issues that are well known to farmers and highly relevant to farming practice—such as energetic lines on farmland that may influence animal behaviour—remain understudied. Scientists commonly believe they ought to exclude such topics, as they do not align with the dominant epistemic culture of science (normative rules). As will be explained in the following section, this epistemic culture of scientists is largely based on explicit, discursive knowledge, rather than the tacit knowledge that is widely used in farming practices.

The results of this study indicate that the epistemic culture of the scientific regime is selective and tends to discredit work that does not fit well within the existing body of scientific knowledge, regardless of its relevance for farmers. Researchers who seek to explore new fields or investigate issues that have not previously been researched are often criticised by the media, the Executive Board, and even their own colleagues. In one case, interviewees reported that colleagues even claimed such research was forbidden by the Bible, which represents a distinct epistemic culture, yet one that has nevertheless influenced Western science. The findings of the present study clarify the authoritarian manner in which legitimate knowledge and legitimate research are defined and controlled at Wageningen UR, and what is excluded.

Interviewees suggested that the current governance model of universities does not facilitate research in fields where little money can be earned or which are perceived as unscientific, such as homeopathic treatments for animals. As one interviewee explained: “You will never prove the effects with scientific evidence, and no one wants to pay for it. If I see conventional farmers using it anyway, I ask them why, and they tell me simply because it works, based on experience. Veterinarians are often much more opposed to it; there are a few who support it, but most try to stay far away from it.”

In the case of natural treatments or self-medication by cows, the producers of medicines or feed additives are reluctant to support such changes, as their income depends on the sale of these products. If cows could be treated using resources freely available in nature, these companies would lose revenue. During one of the NLF meetings, a veterinarian stated that the same economic logic applies to many veterinarians. Veterinarian and researcher Maria Groot explained that between 11 and 20 per cent of what monkeys consume in the wild is not food, but serves medicinal or health-enhancing purposes, such as tree bark or seeds. However, she also noted that her research institute (RIKILT) depends heavily on external funding and research contracts, making it difficult to secure funding for this type of research, despite its potential relevance for Natural Livestock Farming.

The study also highlighted the influence of media attention and external organisations, such as the Bond tegen de Kwakzalverij, which claim authority to legitimise or delegitimise knowledge. This influence appears to concern corporate communication departments at universities, prompting them to introduce restrictive procedures aimed at controlling what scientific staff may do or say in public, in order to avoid controversial media exposure.

Interviewees further indicated a missing link between the curriculum and orientation of studies at Wageningen UR and agricultural practice, including education at AOCs, thereby underscoring the existence of distinct epistemic cultures. One interviewee reflected on a field trip involving both AOC students and Wageningen University students: “There were students from Wageningen who did not dare to ask a single question because they did not understand what it was about. They did not know what a cell number was, they did not know what the calving interval was—they knew nothing at all—while the AOC students just talked about it naturally. They

were practical. At first, I wondered whether that made sense. Then one Wageningen student, in his fourth year, drove with me, and I asked him what he had learned. He said: ‘I learned a lot, because I really did not want to open my mouth—I would have sounded terrible.’ He was almost finished with Animal Sciences, but had hardly ever seen a cow.”

Moreover, the director of a cluster of AOCs and former manager at Wageningen UR spoke about the different lifeworlds of AOC teachers and scientists. He stated that it is very difficult to recruit teachers with a Wageningen background, and explained that AOC teachers are sometimes reluctant to visit the university: “When you drive onto the campus there is a very small threshold. It looks insignificant, but for many people it is a huge barrier to entering the campus, attending a seminar, or going into the library. We therefore have to work very hard on the professionalisation of teachers, so they can bring those competencies back into their teams.” When asked who informs policymakers, he replied: “People from Wageningen, yes—people without knowledge of craftsmanship. Exactly. That is a circle we need to escape from.”

#### 4.3 THE VOCATIONAL EDUCATION REGIME

##### NORMATIVE RULES IN THE VOCATIONAL EDUCATION REGIME

With regard to normative rules in the education regime, several interviewees raised the issue of role expectations, particularly who is expected to take the lead in initiating change. Directors of AOCs mentioned that transitions toward more sustainability-oriented education should be developed bottom-up, within teams of teachers, and that students should also have a voice in this process. Interviewees from the AOCs further indicated that teachers often do not appreciate external groups or project workers telling them what they should change; according to one AOC teacher, teacher teams respond by saying “we already have our teaching materials.”

By contrast, another teacher stated: “I think if a module on ‘sustainability’ were developed, everyone would use it; teachers simply lack the time to fully explore it themselves.” A former AOC director, now working as a sustainability coordinator, observed that the management team (MT) was waiting for teachers to articulate their wishes regarding sustainability, while teachers were waiting for the MT to provide direction. She emphasised the importance of having explicitly designated members of the management team responsible for sustainability. The report *Nature-Inclusive Agriculture and Agricultural Education* (RVON, 2016) concludes that a similar lack of clarity exists at the macro level: it remains unclear who is responsible for leading change in AOC education, what the role of government should be, and which decisions should be made by the central AOC council. The situation described above is emblematic of the ‘organised irresponsibility’ observed throughout this study with regard to sustainability-related change in AOCs.

Two interviewed sustainability coordinators indicated that the majority of AOC teachers perceive sustainability education as a side project, rather than as a core element of the curriculum. One coordinator reflected on colleagues’ reactions: “They become impatient and ask me when it will be finished.”

Several teachers also discussed normative rules related to perceived role expectations. One AOC sustainability coordinator explained that her colleagues feel responsible for preparing students for farm work in ways that align with students' and parents' expectations. Another teacher suggested that AOC teachers fear resistance from pupils when addressing nature-inclusive agriculture. Many students come from farming families, and teachers adjust their lessons to what they believe is relevant to these students, sometimes experiencing implicit pressure from parents to do so. To illustrate this, one AOC teacher stated: "At this age (his pupils were between 14 and 17), they only think about a few things: feeding, haymaking, milking—only the technical aspects are interesting. After five to ten years, they will start thinking about the ethical licence to produce."

In contrast, one dairy farmer (and parent of an AOC student) stated that she was disappointed by the dominance of conventional agriculture in her son's education and by the limited attention given to organic farming. These findings indicate that teachers are strongly influenced by perceived role expectations—that is, by what they believe pupils and parents expect from them. Once teachers anticipate these normative rules, they may inadvertently obstruct change, as they focus their teaching on what is relevant to the average conventional farm from which many AOC students originate.

Two interviewees pointed to potential mechanisms for changing these normative rules. They suggested that one of the most effective ways to engage students in sustainable agriculture is by introducing them to organic farmers with economically viable business models. One interviewee, a former WUR researcher involved in vocational education at AOCs, acknowledged initial resistance but also described how this could shift students' perspectives: "Students are interested in how to run a farm successfully from a business perspective. In the current regime, the focus is still on quantity and scaling up, which makes it difficult to interest students in small-scale (organic) farming." After visiting a small organic dairy farm with students, he reflected: "At first, students reacted with 'what a peasant,' but when the farmer opened his accounts, they were shocked and impressed by his business model."

Similarly, an AOC teacher described how one student from an organic farm explained his family's practices to classmates. Once classmates understood that this approach was economically profitable, they stopped dismissing it with sceptical remarks and instead began to admire it. These findings suggest that demonstrating viable business models is an effective strategy for engaging AOC students with alternative farming approaches. The RVON report (2016) on the implementation of Nature-Inclusive Agriculture in Dutch education similarly concludes that there is a lack of concrete examples and content knowledge for teaching about profitable nature-inclusive business models. This is attributed to two factors: the dominance of cost-price and business models linked to conventional farming (p. 4), and the long-standing perception of broader agricultural approaches as "hobbyist" practices (RVON, 2016, p. 13).

Returning to the issue of role expectations, interviewees emphasised that teachers are expected to do a great deal within limited time, meaning that the extent to which Nature-Inclusive Agriculture is addressed depends largely on individual teachers' motivation. Teachers must prepare students for final examinations, and if they wish to integrate sustainability into regular lessons, they must often do so on their own initiative. Interviewees

noted that some teachers fear running out of time to complete the prescribed curriculum before exams and therefore avoid making changes. As a former AOC director and sustainability coordinator explained: “For a long time, teachers taught strictly from textbooks. Especially younger teachers were very focused on sticking to the method. But if you stay within that, you become a prisoner of it and you will not get out.”

A director of a cluster of AOCs also pointed to the heavy burden on teaching time resulting from the need to cover regulations applicable to specific farming systems. Nevertheless, several interviewed teachers voluntarily dedicated their own time to teaching about nature-inclusive or sustainable agriculture. One teacher showed the journals he reads on his days off, explaining that this reflects his personal interest and commitment to staying up to date, while acknowledging that not all colleagues are willing or able to do this in their free time.

Finally, a manifesto on the promotion and importance of sustainability, signed in 2009 by the AOC council and the Minister of Agriculture, Nature and Food Quality, was mentioned by interviewees. According to one sustainability coordinator, little priority was given to this manifesto in subsequent years, as management and staff largely continued business as usual: “Once the AOC Council—representing all AOCs—signed that manifesto, everyone was happy: great, nice. But it then remained untouched on a shelf for ten years, *because no one did anything with it*”.

---

#### REGULATIVE RULES IN THE VOCATIONAL EDUCATION REGIME

Regarding regulative rules, several measures have been taken to promote sustainability: all AOC schools appointed sustainability coordinators and signed a covenant of the AOC council. However, the overall formal incentive structure has done little to enable substantive sustainable development. Interviewed AOC teachers stated that most efforts to integrate sustainability into teaching occur in their own time. One AOC director explained that the AOCs faced budget cuts of €50 million in the previous year, resulting in a rapid increase in the teacher–student ratio from 1:15 to 1:20 within a single year. Moreover, these budget cuts meant that project funding for the Green Knowledge Cooperation (GKC)—including projects aimed at more sustainable forms of agriculture—was discontinued.

A new overarching development agenda for agricultural education, which in effect replaces the GKC, has since been established and signed by agribusiness firms. Although this agenda was jointly agreed upon, the agribusiness sector does not contribute financially. One sustainability coordinator mentioned that budget constraints at her AOC sometimes made it impossible to participate in networks or partnerships aimed at collaborative work on sustainable development. Similarly, an AOC director indicated that limited available time meant that teachers rarely had opportunities to visit farms, Wageningen University, or a lector from a School for Higher Agricultural Education.

The explicit AOC curriculum itself can be understood as an embodiment of regulative rules. Several teachers discussed how the formal curriculum constrains and directs their teaching practices. As multiple AOC interviewees noted, vocational agricultural education has increasingly shifted toward working with technical artefacts, protocols, and regulations, thereby displacing professional craftsmanship, in which farmers relate

directly to nature through observation of soil and animals. According to one AOC director, the current regime does precisely the opposite of what is required for sustainable agriculture: “In the past, we taught our students—whether in animal husbandry or arable farming—how to develop good soil structure, how to observe it, how to judge it, how to put a spade in the ground and see how deep the roots were. Nowadays we say: ‘You have to know when you are allowed to spread manure, and that is determined by legislation from The Hague.’ What used to be something a farmer could feel and develop sensitivity for is now prescribed from above.”

He added that preparing AOC students for nature-inclusive agriculture instead requires re-teaching the profession itself: the ability to work with nature, to observe, and to sense key indicators, rather than following rules and applying technical artefacts. He emphasised this by stating: “The craftsmanship is being removed from the profession, and that has very significant consequences for the structure of the sector.”

The extent to which sustainability is explicitly supported varies considerably across AOCs. Some schools employ a sustainability coordinator for only two hours per week, while three other AOCs appointed members of expert development teams for sustainability for merely 20 hours per year. In contrast, another AOC employs a sustainability coordinator for two days per week throughout the year. Part of the available budget for integrating sustainability into education is spent on consortia. This study examined one such consortium involving three AOCs, two scientists, and an independent research bureau (which wrote the project proposal and applied for funding). Analysis of the budget revealed that a substantial share of government funding intended to improve education went to the scientists and the research bureau, rather than to the schools themselves.

This consortium involved many external actors (consultants, advisors, and scientists) and only a small number of school staff (one person per school). This arrangement contradicts what interviewees in this study identified as desirable, and it even runs counter to the consortium’s own stated ambition of adopting a “Whole School Approach.”

---

#### SOCIO-COGNITIVE RULES IN THE VOCATIONAL EDUCATION REGIME

This section addresses socio-cognitive rules, which operate at the deepest level of the regime and are often difficult to observe (Scott, 2008). Several interviewees noted that they, and their colleagues, tend to align their teaching with the expectations of pupils and their parents, with a strong focus on the technical aspects of agricultural production.

A socio-cognitive challenge highlighted by an AOC teacher and member of an expert development team on sustainability was the difficulty of defining what “sustainability” entails and what exactly needs to be addressed. In the first year of the team, they struggled to get started, he explained, partly due to lack of clarity and limited available time (20 hours for the entire year).

For some teachers, the ambiguity around the concept of sustainability became demotivating. One interviewed AOC teacher explained:

“The term sustainable is used whether appropriate or not. What do you mean by sustainability? In dairy farming, they also talk about ‘sustainable cows’—cows that last a long time—but sustainability, I think, is a much broader concept; you have to involve the entire planet. Because it has become such a buzzword, everyone uses it. Even feed manufacturers claim they work on sustainability and innovation, but the content is very vague.”

This teacher described how the overuse and hype around sustainability had reduced her motivation to initiate projects, saying:

“I used to ask my students: ‘What is well-being? What is sustainability? What is innovation?’ but now that everyone is so excited about it, I don’t really feel like doing those kinds of projects anymore.”

These examples illustrate how socio-cognitive rules stabilize existing practices by slowing down or obstructing change in the education regime.

Another interviewee emphasized how understandings of sustainability vary widely. She described a project in which sustainability was interpreted as increasing farm size by 3000%. When asked if her school’s management valued sustainability, she responded:

“Yes, they are very much into this. The embassy of Sri Lanka approached our school to collaborate, because farmers there often have just two cows and would like to scale up. My colleague will soon go there and assess what knowledge they need, so they can maybe even scale up to sixty cows.”

These examples show that different frames of meaning and life-worlds among AOC employees can make it difficult to operationalize sustainable agriculture initiatives. Depending on the perspectives of the actors in charge, sustainability can be implemented in vastly different ways.

One sustainability coordinator explained that at her school, sustainability was focused more on visible, physical aspects rather than being embedded in practices and mindset:

“We are still very much looking at appearances, for visibility—solar panels, water drainage—but it is not yet in the genes of our students. Getting there requires a change in didactics.”

The deep-level influence of socio-cognitive rules also becomes evident in the interaction between schools with different agricultural philosophies. When asked whether her branch collaborated with the bio-dynamic branch of the AOC, a sustainability coordinator from the conventional branch explained:

“No, we hardly work together. It’s unfortunate, but you have to understand, this is a very different school of thought.”

She acknowledged that the bio-dynamic branch could offer examples aligned with sustainable development, but it would not fit the life-world of the conventional school, and she seemed to take for granted that colleagues would resist such integration.

Finally, an interviewed veterinarian and member of the Foundation for Natural Livestock Farming suggested that it would be beneficial to reintegrate knowledge of natural products, which many farmers still use, into the curriculum. At the same time, herb-rich grasslands could also be addressed as part of sustainable agricultural education.

#### SUMMARY OF THE RULES IN THIS REGIME

The experienced lack of resources to embed sustainability at the AOCs highlights two main mechanisms that keep agricultural education locked into a regime serving conventional farming and the agro-industrial system. First, “organized irresponsibility”, manifested in the lack of clarity regarding roles and responsibilities in the transition toward more sustainable development. Second, the anticipation by teachers of perceived expectations from pupils and parents regarding what ought to be taught.

Vocational education increasingly focuses on technical artefacts, protocols, and regulations, replacing professional craftsmanship in which farmers relate directly to nature, for example through observing soil quality or animal behaviour firsthand. Formally, all AOC schools in this study had a sustainability coordinator and had signed a covenant of the AOC council to make the schools more environmentally friendly and to incorporate knowledge related to sustainable agriculture. At the normative level, sustainability coordinators observed considerable variation in support and interest from colleagues and the management team. At the socio-cognitive level, teachers were influenced by role expectations: some colleagues treated sustainability projects as temporary tasks and wondered when they would be “finished,” failing to recognize that these initiatives are intended as continuous, ongoing trajectories for improvement.

Budget cuts since 2018 further reduced the teacher/pupil ratio, leaving less time for teachers to develop new lesson material. Moreover, there are no structural formal incentives for teachers to educate about sustainable or nature-inclusive agriculture, while much of the available project funding is absorbed by external actors in consortia.

In the current education regime, the study results suggest that learning about nature-inclusive or sustainable agriculture is particularly effective when students understand the profitability of alternative business models. However, such approaches are not yet embedded in the core curriculum of the AOCs, limiting students’ exposure to viable pathways for more sustainable farming.

#### EPISTEMIC CULTURE(S) IN VOCATIONAL AGRICULTURAL EDUCATION

Various epistemic cultures intersect within AOCs, creating both opportunities and challenges for teaching nature-inclusive agriculture. Many AOC pupils come from farms and bring tacit knowledge from daily life: “They know exactly what is going on in the sector, they discuss this each day at the kitchen table,” as one AOC

director observed. At the same time, fewer AOC teachers have a farming background. One teacher explained: “It is a pity, but the number of farms is decreasing rapidly, so the number of people who grew up on a farm also decreases. Now I see some colleagues find it hard to understand the life-worlds of the pupils who come from farms.” This highlights the differences in epistemic culture between those who grew up on farms and those who did not.

Several interviewees pointed to a loss of tacit knowledge among pupils, largely due to regulations and technical artefacts replacing hands-on experience. For example, one AOC director explained that lists and measuring techniques are now used to indicate when pigs are ready for slaughter, which de-skills farmers from observing readiness themselves. Similarly, an AOC teacher highlighted that knowledge about grazing management has largely disappeared over the last 2–3 generations, as more farmers keep cows indoors. He stated: “So that’s what our boys have to work on now. And we first have to start with the basics of grazing and bring that back in thoroughly.”

The loss of tacit knowledge extends to soil management: a director noted that a decade or two ago, pupils learned to identify good soil structure, examine roots, and take soil samples, whereas today the curriculum focuses on knowing regulations from The Hague on manure application. He emphasized that these changes remove craftsmanship from the profession.

AOC teachers also experience barriers in accessing knowledge from Wageningen UR. The director of a cluster of AOCs noted that teachers rarely visit the university, not only due to time constraints, but also because the campus can seem intimidating: “The little threshold when you enter the campus can appear really high to them.” Conversely, Wageningen UR staff and students often lack awareness of developments at the AOCs, which is problematic since graduates from both institutions will need to collaborate in the future.

Collaboration across epistemic cultures is further limited by perceived differences in approach. Two teachers indicated that consulting the bio-dynamic school Warmonderhof for ideas on nature-inclusive agriculture was “a step too far, a too different school of thoughts.” Desk research confirmed that AOC teachers often perceive Wageningen UR knowledge as oriented toward conventional farming rather than nature-inclusive agriculture (RVON, 2016). Furthermore, Wageningen UR reports are often written in language difficult for AOC pupils to understand, making integration into AOC classes challenging. The latter obstacle was also mentioned by several AOC teachers in the study at hand.

## 5. CONCLUSION AND DISCUSSION

In this chapter the conclusions of the research are presented, starting with an elaboration of the three sub questions, together providing an answer to the central research question. In the discussion a reflection is given on the research design and execution. Theories from the conceptual framework, together with the major findings, are discussed. This chapter will end with recommendations for future research.

### 5.1 CONCLUSION

#### QUESTION 1

When studying the stabilizing mechanisms of the regimes, the three types of rules of Scott (2008), were used as an analytical tool. Table 4 shows the most important rules per regime, or better said: the rules emphasised by a number of interviewees and participants in this research and often confirmed in observations. This provides an answer to research question 1.

	REGULATIVE	NORMATIVE	SOCIO-COGNITIVE
Production regime	Stabilization maintained by: incentive structure focused on intensive agriculture, unclarity on subsidies and policies related to NIA. Moreover, because of regulations and standardisation (by food retailers, industry and government) certain tacit farmers' knowledge was no longer used, because of prescribed practices. (interlinked with socio-cognitive rules)	Farmers' distrust in the aims and intention of policy makers and scientists. Justified beliefs of 'good practices' closely related to tacit knowledge, observations and experiences, regardless of scientific proof. No normative stabilizing mechanism indicated.	Modernized farms become dependent on external experts and craftsmanship has decreased, which obstructs changes to more natural approaches. Moreover, farmers' knowledge is neglected by scientists and policymakers which obstructs collaborative changes. Long-term trend of intensification and up-scaling (economically and cognitively stuck), has led to a loss of tacit knowledge on natural farming.
Science regime	Stabilization caused by incentive structure for collaboration of industry-government-science whose 'privileged way forward' is incremental change, no radical change. No formal incentives to study farmers' problems in the science regime. Time restrictions due to project-based funding. (interlinked with socio-cognitive and normative rules)	stabilization enhanced by beliefs of legitimacy of knowledge creation and co-creation with a select group of resourceful partners. Fixed beliefs of what scientists ought to do, exclude perspectives and activities which may be crucial for transition.	Taken for granted collaborations with (conventional) business partners in setting the research agenda, while neglecting farmers interests. Boundaries to what is believed to be researchable due to epistemic culture of scientists, excluding relevant issues from the farmers. Stabilizing effect: scientific support for currently dominant practices

Vocational education regime	Curriculum predominantly focused on conventional agriculture, and new regulations and technical artefacts. NIA-related course material needs to come from teachers themselves, created in their free time, without formal incentive mechanism.	Unclear responsibilities, neither teachers, nor the MT take the lead to embed NIA at the AOCs, 'organized irresponsibility'. Perceived role expectations are biased towards teaching for conventional farming.	Hard to find teachable content knowledge, (e.g. profitable business models of NIA) since existing knowledge focussed on conventional farming. Different conceptions of 'sustainable' and of what needs to be prioritized have slowed down embedding of NIA.
-----------------------------	--	--	---

Table 4: Change obstructing rules per regime

---

## QUESTION 2

With the overview presented in the table above we can proceed to research question 2, assessing stabilizing effects of these rules in the regimes. These will be described per regime.

In the agricultural production regime, the most change obstructing factor was the lack of resources farmers perceived they have access to (for changing their farming model). This can be seen as a stabilizing mechanism related to the regulative rules: there are policies and subsidies to stimulate Nature Inclusive Agriculture, but farmers indicated that the rules to apply for these were unclear and not stable enough. As the interviewees explained, only farmers in certain appointed areas could apply for subsidies for Nature Inclusive Agriculture.

Another stabilizing mechanism is the tendency to increase farm size. This stability results from *socio-cognitive* rules, i.e., taken-for-granted, shared beliefs, as well as *regulative rules*, i.e. the incentive structure. Exemplary for the socio-cognitive rules in the production regime is the fact that many farmers perceive upscaling as a proof of success, while still holding on to conventional business model (even if these models are unsustainable ecologically as well as economically). Throughout this study it was confirmed that most farmers aim to produce more, have more cows than their parents and even the banks often require quantitative growth as a criterion for getting a loan. Only after seeing a highly profitable alternative business model from a small-scale farmer, the idea starts to catch more attention and interest (NLF, 2017).

Moreover, few interviewees doubted whether a rapid transition to Nature Inclusive Agriculture in the Netherlands would be good (normative), one in the context of the globalized world market, and another because he believed it was not more sustainable resource-wise. Governmental policy makers have been framing scale increase as a solution for the Dutch agricultural system for a long time (Lieshout, Dewulf, Aarts & Termeer, 2013).

The process of scale increase went hand in hand with the loss of tacit farmers' knowledge, knowledge which is relevant for reintroducing natural approaches to farming, nowadays known under the name Nature Inclusive Agriculture. This underlines the importance of being aware of the distinct epistemic cultures, as will be addressed in answering research question 3 below.

In the *science regime*, the interviewed researchers and university staff expressed their wish to study sustainable development and/or NIA more in collaboration with farmers. Nevertheless, the research agendas were still composed together with those who contribute to funding the research, i.e. resourceful companies. This practice is maintained by socio-cognitive rules, embodied in the usual partnerships, as well as regulative rules, observed in the incentive structure. These two rules combined enhance stability in the science regime. Resourceful companies from the current regime have little interest in radical change, rather than incremental change.

Regarding socio-cognitive rules in the science regime, certain tendencies, habits and frames of meaning making seem to evolve in interaction with regulative rules. The criteria for promotion in the Tenure Track may influence the socio-cognitive level of the scientists, if certain quantitative scores (e.g. number of publications in scientific journals and amount of external funding for research projects) become criteria for promotion, these influence the frames of meaning making and the perceptions of what reasonable others would do. The mentioned criteria to succeed in the science regime, seem to be more directed toward incremental change rather than radical change.

In the *vocational education regime*, we have seen that budget cuts, i.e. regulative rules, cause teachers to have little time to adopt sustainability in the curriculum and expectation patterns regarding AOC educating (normative rules). These two types of rules reinforce stability. With the little hours available to work on sustainability, they faced a challenge at the cognitive level, as the teachers took for granted that they had to keep teaching the type of farm management the pupils knew from back home, which was mostly conventional agriculture.

---

### QUESTION 3

With regard to research question 3, on the epistemic cultures and their relations with the three types of rules, I conclude that it is shown that the three types of rules are a great analytical tool to explore epistemic cultures. The overview of the three types of rules in the regimes helps to answer two questions related to epistemic cultures: *how do we know what we know?* (Knorr-Cetina, 1999) and *what makes justified beliefs justified?* (Steup, 1996).

This study explored the different epistemic cultures, highlighting their relations with the three types of rules. Besides the epistemic cultures of the three regimes, there was a crucial role for the epistemic culture of policymakers.

Policymakers operate in the epistemic culture of the scientists more than the epistemic culture of farmers, because many agricultural policymakers are academically educated (often in Wageningen) and have little practical experience in farming. A problem is the generalizing character of policies (as exemplified by the manure-injection regulations). The conditions of farms and their environments are so diverse that generalized policies do not seem to be suitable, nor functional or effective. As several stakeholders mentioned in the interviews, this is exactly the problem, as those in charge of making the policies have too much of an academic

approach, while the logics and organisation of farm practice is determined by tacit, practical and local knowledge. This finding is relevant nowadays, because the changes toward more Nature Inclusive Agriculture require policymakers to take into account the farmers' knowledge and context, instead of implementing generalized policies based on scientific knowledge.

With regard to justified beliefs, as part of epistemic cultures, research agendas are based on the belief that agricultural systems have to produce for the world market, a belief which is shared by resourceful companies in the agricultural sector (as confirmed by desk- research). WUR tries to communicate these research agendas as serving the common good, framing it in terms of '0 hunger' and 'feeding the world'. While neglecting the perspective of food sovereignty and the belief that producing for local markets with diversity in agriculture is the way forward.

Moreover, with regard to the role of epistemic cultures in the three regimes, the findings of this study are in line with what Klerkx (2008) indicated concerning farmers' trust in the government. Farmers indicate not only a distrust in government policies, but also distrust the intentions and support from Wageningen UR. The same is true for the farmers perception of the University of Utrecht, according to my interviewees, livestock farmers would not count on the veterinarian faculty to address their problems related to animal health. This seems to result from the distinct epistemic culture of the farmers in the production regime and the scientists in the science regime.

In the epistemic culture of scientists, a technique or practice of which the functioning cannot be explained in words is easily rejected. In the production regime of the farmers, the practical functioning is more important than the explanation in words of how it exactly works. The research at hand also indicates the lack of generalists in the science regime, which makes communication between researchers and farmers hard, because at a farm (and in nature in general) everything is in dynamic interaction with everything else. If a scientist only has expertise on one detail this is an obstacle for their communication and collaboration with farmers, while exactly this would be desirable to enable the transition to more NIA. There is no formal incentive structure to stimulate communication between scientists and farmers. Articles for farmers' journals from Wageningen UR are written by the communication department instead of by the scientists themselves.

Intensive agriculture, which was promoted by the 'no hunger' discourse after the second world war and later the 'feeding the world' discourse, went hand in hand with a loss of skills and implicit knowledge needed for extensive agriculture. This is supported by examples regarding knowledge on grazing and use of herbal medicines.

The above mentioned regime rules exemplify the mechanism of stabilization of the regimes which slows down the transition to alternative approaches, due to the long-entrenched interest of the regime in production and scale-increase. The regimes seem to have integrated this 'privileged way forward' in their epistemic cultures.

---

## MAIN RESEARCH QUESTION

The answers to the sub-questions together answer the main research question:

*How do stabilizing rules in the vocational education, agricultural production and science regimes obstruct change toward more Nature Inclusive Agriculture in The Netherlands and how do they relate to epistemic cultures?*

Most stabilizing effects found in this research derive from the deepest level, the *socio-cognitive rules*, including routines and taken for granted assumptions, enhanced by *regulative rules* especially incentive structures which stimulate actors to keep doing 'business as usual'. In the study at hand, it was found that this strongly relates to the epistemic cultures of the regimes. The distinct epistemic cultures analysed with the rules in each regime, indicate that these distinct epistemic cultures can obstruct changes within the regimes as well as in collaboration among the regimes. The findings of this study suggest that in order for policymakers, scientists, AOCs and farmers to collaboratively make agriculture more nature inclusive, they will have to acknowledge the relevance and importance of each other's knowledge even if it does not fit with the logics of their own epistemic culture. Regulations may be in place (regulative) to promote change in the farmers regime (i.e. for Nature Inclusive Agriculture), but if regulations are not clear, or perceived legitimacy is missing (normative) the regulative rules will be less effective.

## 5.2 DISCUSSION

This chapter reflects on the main findings of the research in terms of its contributions to: the key issues of the case study, the research methodology applied to these issues, and the participatory approach.

Firstly, I have to say, this study gives limited insights into change-obstructing rules in the *policy regime*, whereas the findings imply that it was an important regime in interaction with the three regimes I did assess. No interviews were conducted with governmental policymakers. Nevertheless, relevant policies and their effects have been discussed per regime, in the sections on regulative rules. I believe this is sufficient and separate assessment of rules in the policy regime would have led to a lot of overlap in the results. This could also be interesting for showing the interlinkages.

While this study found a strong relation between the rules and the epistemic cultures of regimes, which seemed to mutually reinforce each other, the study at hand did not study the rules especially applying to the epistemic cultures, while this could have been an important focus.

Reflecting on this research, I see that the scope of my research is very wide and caused difficulties in collecting data and presenting results in a coherent manner. I believe the study would have been of better quality if it had only focused on rules related to knowledge in each regime. In the best case, I would have done that from the beginning, so I would have collected more rich data with regard to knowledge and epistemic cultures. Also, a focus on one element of Nature Inclusive Agriculture e.g. herb-rich pastures at dairy farms, would have been more likely to give strong results. I could have studied the knowledge and beliefs as well as practices around

this specific topic in each regime and then made a stronger comparison and better indicate the stabilizing effects in and among the regimes.

Ten years apart, Bouma & Marijnissen (2018, Trouw De Staat van de Boer) and Klerkx, Grip & Leeuwis (2006), both indicated a similar problem that prevents farmers from making changes at their farm to serve the public interest: a lack of clarity of policies and regulations. Results in the study at hand confirm this and uncover a possible reason for these stabilizing effects. The observed differences in distinct epistemic cultures of farmers and scientists are relevant here. Policies are created by policy makers who often are academically educated and base their policies (partly) on academic research, whereas the characteristics of this kind of knowledge differ a lot from the characteristics of knowledge that is relevant at the farm level, i.e. farmers' tacit knowledge. Likewise, critical studies emphasise a continuous predomination of developments serving the dominant perception of the 'privileged way forward' in agricultural systems (Lieshout et. al. 2013, Wiskerke 2003, Erjavec & Erjavec 2009). Moreover, the International Panel of Experts on Sustainable Food Systems report (IPES-Food, 2016) underlines that complexity and interlinkages at the farm level are often not recognized in research, since researchers are trained in their own specific discipline.

As the IPES (2016) report mentions, that educational systems can act as a roadblock against alternative models and systemic approaches. In the book of Corcoran, Weakland & Wals (2017) Akpezi Ogbuigwe points out that environmental and sustainability education has to rearrange *the 'disorder' created by industrialization, unrestrained technological advancement, and inequities*. The findings of this study do not indicate that this is happening yet at the AOCs. The study at hand indicates that the efforts for integrating sustainability and nature inclusive agriculture in the OACs' education are still marginal and depend on individual teachers. The core of the curriculum is focused on equipping pupils to work at conventional farms. Caution is needed regarding the reproductive character of vocational education, in times where transition and radical changes are needed in agriculture.

In the study at hand the three types of rules of Scott (1995) served as a useful analytical tool. In line with the suggestion of Geels (2004) the types of rules were used to explore the different stabilizing mechanisms in regimes. Throughout the analysis of the data, I noticed that interviews are not the best way to research the 'socio-cognitive rules'. This is understandable, for this is the deepest: the beliefs of people about what reasonable others would do, the things they taken-for-granted, assumptions and habits (Scott, 2008). Socio-cognitive rules often exist beyond the awareness of the people involved, let alone that they could tell about it in an interview. This can better be uncovered by long-term participatory research, which was also done in this study by following the study group on Natural Livestock Farming and the consortium on sustainable development at the AOCs. The rules of each rule type need their own way of approaching them in research, but if done properly, this division gives additional insights into where transitions get stuck. Moreover, when linked with the epistemic cultures from the beginning, the change-obstructing rules with this specific focus could have been highlighted. This approach can give interesting results, because the differences in epistemic cultures stabilize collaborative change in the system.

The study uncovers the stabilization of rules and routines in the scientific agenda setting and related government innovation policies, regardless of their lack of effectiveness, which Leeuwis (2000) already warned about and which The Netherlands Court of Audit also indicated (Kempkes et.al. 2011). When it comes to publicly funded R&D, in which the public interest is to develop creative ideas in order to facilitate change, Leeuwis (2000) recalls that a strong focus on pre-defined results may be counterproductive. I believe this study gives extra context and new examples which are in line with the findings of Leeuwis (2000), and it is indicative of strong stabilization to observe that almost two decades later, Wageningen University & Research Centre still predominantly composes the research agenda with -and in the interest of- actors from the conventional agro-food industry. They together hold on to a problem definition of 'feeding the world' as something that can be approached at a general level worldwide and that can be solved with technological solutions. This perspective is framed as the responsibility of Wageningen UR, through which they legitimize their practices and interferences in food systems all over the world (Wageningen UR Strategic Agenda 2018-2021).

### 5.3 RECOMMENDATIONS

Based on the findings of this research, especially related to the different epistemic cultures, it would be useful to assess what the role of more practically educated actors, as change agents, could be. This could be non-academic people with experience in farming, operating as knowledge brokers between the scientists, policy makers, and farmers. A study can be done on the changes in farmers' trust in policies when they are communicating with a practically educated and experienced intermediary (former AOC student) compared to when they communicate with a (scientifically educated) policymaker directly.

Based on this study, I would recommend assessing the difference (i.e. in frames of meaning making) between WUR students with and without practical farm experience. The hypothesis could be that those with practical knowledge also have an increased awareness of the existence and importance of farmers' knowledge (as an epistemic culture distinct from the science culture) and can anticipate this better in their studies. A research site for this study could be The Farm Experience Internship, organized annually by the Farmers' Foundation, Stichting Boerengroep, in Wageningen.

- Bogdan, R. C. & Biklen, S. K. (2006). *Qualitative research in education: An introduction to theory and methods*. Allyn & Bacon. [ISBN 978-0-205-51225-6](#).
- Bouma, J. & Marijnissen, H. (2018). Boer wil verduurzamen om uit de crisis te komen. Trouw 19/06/2018 De Staat van de Boer <https://www.trouw.nl/groen/boer-wil-verduurzamen-om-uit-de-crisis-te-komen~a9091ad5/> last consulted online: 7/30/2018
- CBS (2018). Monitor Brede Welvaart 2018. ISBN 978-90-357-2128-9 <https://www.cbs.nl/nl-nl/publicatie/2018/20/monitor-brede-welvaart-2018> last consulted online: 8/19/2018
- Corcoran, P.B., Weakland, J.P., Wals, A.E.J., (2017). *Envisioning futures for environmental and sustainability education* ISBN: 978-90-8686-303-7
- Van Dijk, J., Verburg, R., Runhaar, H. & Hekkert, M., (2018). Een transitie naar natuur-inclusieve landbouw: van 'waarom' naar 'hoe"', *Me Judice*, 3 mei 2018. <http://www.mejudice.nl/artikelen/detail/een-transitie-naar-natuurinclusieve-landbouw-van-waarom-naar-hoe> last consulted online: 8/20/2018
- Erisman, J. W., Eekeren, N. Van, Doorn, A. Van, Geertsema, W., & Polman, N. (2017). *Maatregelen natuurinclusieve landbouw*, 1–50. <http://www.louisbolk.org/downloads/3260.pdf>
- Francis, C. M. & Campbell, M. C. (2003). A report for the Rural Industries Research and Development Corporation: New high quality oil seed crops for temperate and tropical Australia. RIRDC Project No UWA-47A. RIRDC Publication No 03/045
- Geels, F. W. (2004). 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.
- Giddens, A. (1984). The constitution of society: Outline of the theory of structuration. *Cognitive Therapy and Research*, 12(4), 448. <http://doi.org/10.1007/BF01173303>
- Healy, S. (2001). Fact and Value. Privileging process over fact': the Sydney water scare as 'organised irresponsibility'. *Science and Public Policy*, volume 28 (2), April 2001, pages 123-129. Beech Tree Publishing, 10 Watford Close, Guildford, Surrey GU1 2EP, England
- Hiedanpää, J., Kotilainen, J., & Salo, M. (2011). Unfolding the organised irresponsibility: Ecosystem approach and the quest for forest biodiversity in Finland, Peru, and Russia. *Forest Policy and Economics*, 13(3), 159–165. <http://doi.org/10.1016/j.forpol.2010.11.007>
- Hobart, M. (1993). *An Anthropological Critique of Development: the growth of ignorance*, Routledge, London and New York

IPES-Food (2016). From uniformity to diversity: a paradigm shift from industrial agriculture to diversified agroecological systems. International Panel of Experts on Sustainable Food systems. Uniformity Diversity From Uniformity. *Revista Mexicana de Investigación Educativa RMIE*, 17(55), 32–61. <http://doi.org/IPES-Food>.

Kemp, R., Schot, J., & Hoogma, R. (1998). Regime shifts to sustainability through processes of niche formation: The approach of strategic niche management. *Technology Analysis & Strategic Management*, 10(2), 175–195. <http://doi.org/10.1080/09537329808524310>

Kempkes, P., van As, S., van Dijk, H., van der Geest RE, H., van Maasacker, M., van Rossum Elfferich, M. (2011). Innovatie beleid. Algemene Rekenkamer, Sdu Uitgevers, Den Haag

Klerkx, L., Grip, K. de & Leeuwis, C. (2006). Hands off but strings attached The contradictions of policy-induced demand-driven agricultural extension Published in *Agriculture and Human Values* (2006), 23:189-204

Klerkx, L. (2008). Matching demand and supply in the Dutch agricultural knowledge infrastructure. The emergence and embedding of new intermediaries in an agricultural innovation system in transition. Wageningen University.

Klitkou, A., Bolwig, S., Hansen, T., & Wessberg, N. (2015). The role of lock-in mechanisms in transition processes: The case of energy for road transport. *Environmental Innovation and Societal Transitions*, 16, 22–37. <http://doi.org/10.1016/j.eist.2015.07.005>

Knorr-Cetina, K. (1999). *Epistemic Cultures: How the Sciences Make Knowledge*. Harvard University Press ISBN 9780674258945

Leeuwis, C. (2000). Learning to be sustainable. Does the Dutch agrarian knowledge market fail? *Journal of Agricultural Education and Extension* 7 (2), 79-92

Leeuwis, C. (2004). *Communication for Rural Innovation: Rethinking Agricultural Extension*. Third edition with contribution from Anne van den Ban. Blackwell Science Ltd. ISBN 0–632–05249–X

Van Lieshout, M., Dewulf, A., Aarts, N., & Termeer, C. (2013). Framing scale increase in Dutch agricultural policy 1950-2012. *NJAS - Wageningen Journal of Life Sciences*, 64–65, 35–46. <https://doi.org/10.1016/j.njas.2013.02.001>

Van Mierlo, B., Van Amstel, M., Arkesteijn, M., & Elzen, B. (2010). Keeping the ambition high. The value of reflexive monitoring in action for system innovation projects, (JULY), 1–13.

Ministry of Education, Culture and Science (2015). The value of knowledge. Strategic Agenda for Higher Education and Research 2015-2025. Directie Hoger Onderwijs & Studiefinanciering <https://www.rijksoverheid.nl/documenten/beleidsnota-s/2015/07/07/de-waarde-n-van-weten-strategische-agenda-hoger-onderwijs-en-onderzoek-2015-2025> last consulted online: 21/8/2018

Muscio, A., Quaglione, D. & Vallanti, G. (2013). Does government funding complement or substitute private research funding to universities? *Research Policy* 42, 63–75. doi:10.1016/j.respol.2012.04.010

De Nooy-van Tol, J. (2013). *Heel de Wereld*. 1<sup>e</sup> druk. Publisher: Samenwerkende Uitgevers Vof. ISBN 9789062245284

Potts, S.G., Biesmeijer, J.C., Kremen, C., Neumann, P., Schweiger, O. & Kunin, W.E. (2010). Global pollinator declines: trends, impacts and drivers, *Trends in Ecology & Evolution*, Volume 25, Issue 6, 2010, Pages 345-353, ISSN 0169-5347, <https://doi.org/10.1016/j.tree.2010.01.007>.  
<http://www.sciencedirect.com/science/article/pii/S0169534710000364>

*Regeerakkoord 2017–2021* (2017). *Vertrouwen in de toekomst*. VVD, CDA, D66 en ChristenUnie, 2017. consulted online 23/06/2018:  
<https://www.tweedekamer.nl/sites/default/files/atoms/files/regeerakkoord20172021.pdf>

RMNO (1998). *Twaalf essays over integraal ruimtegebruik. Ingrediënten voor een duurzame samenleving*. Raad voor het Milieu- en Natuuronderzoek. RMNO nummer 129. Publisher: Samsom H.D. Tjeenk Willink, Alphen aan de Rijn, 1998

Rijksoverheid (2016). *Food of the Future – The Future of Food*. Discussiepaper van het Nederlandse Voorzitterschap.  
<https://www.rijksoverheid.nl/binaries/rijksoverheid/documenten/rapporten/2016/05/21/discussie-paper-informeel-landbouwrapraad/discussie-paper-informeel-landbouwrapraad.pdf> last consulted online: 20/8/2018

RVON (2016). Rijkdienst voor Ondernemend Nederland. *Natuur inclusieve landbouw in agrarisch onderwijs*, (november). In opdracht van het Ministerie van Economische zaken, Directie Natuur en Biodiversiteit.  
<http://edepot.wur.nl/412683> last consulted online: 21/8/2018

Scott, W. R. (2008). Three pillars of institutions. *Institutions and Organizations: Ideas and Interests*.  
[http://doi.org/10.1016/S0263-2373\(97\)89895-7](http://doi.org/10.1016/S0263-2373(97)89895-7)

Scott, J.C. (1995). *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*. Yale University Press, New Haven.

Steup, M. (1996). *An Introduction to Contemporary Epistemology*. Upper Saddle River: Prentice Hall.

Stuiver, M., Leeuwis, C. & Van der Ploeg, J.D. (2004). The Power of Experience: Farmers' Knowledge and sustainable Innovations in Agriculture. In *Seeds of Transition: Essays on novelty production, niches and regimes in agriculture*. (2004) Eds Wiskerke, J. S. C., & Ploeg, J. D. van der.

Suchman, M.C. (1995). Managing legitimacy: Strategic and institutional approaches. *Academy of Management Review* 20 571-610

Tollens, E., Tavernier, J.D.T., (2006). World food security and agriculture in a globalizing world. Challenges and ethics. *Ethical Perspectives* 13, 93–117. doi:10.2143/EP.13.1.2011788

Unruh, G.C., (2000). Understanding carbon lock-in. *Energy Policy* 28, 817–830.

Wageningen UR (2016). Strategic plan Wageningen University & Research 2015 – 2018.

[https://issuu.com/wageningenur/docs/8412101823\\_cc\\_strategisch\\_plan\\_uk](https://issuu.com/wageningenur/docs/8412101823_cc_strategisch_plan_uk) | last consulted online: 20/8/2018

Wageningen UR & Wageningen economic Research (2017). Resilience Symposium

<https://www.wur.nl/nl/activiteit/Resilience-Symposium.htm> last consulted online: 20/8/2018

Wageningen UR (2018). Professors of Wageningen. [https://www.wur.nl/upload\\_mm/5/9/d/705109ea-bf24-4b11-9845-e9b438c35794\\_Professors%20of%20Wageningen%20University%20-%20Internet%20april%202018.pdf](https://www.wur.nl/upload_mm/5/9/d/705109ea-bf24-4b11-9845-e9b438c35794_Professors%20of%20Wageningen%20University%20-%20Internet%20april%202018.pdf) last consulted online: 20/8/2018

Weber, M. & Rohracher, H. (2012). Legitimizing research, technology and innovation policies for transformative change: Combining insights from innovation systems and multi-level perspective in a comprehensive ‘failures’ framework. *Research Policy* 41(6): 1037–1047.

Wiskerke, J. S. C., & Ploeg, J. D. van der. (2004). *Seeds of Transition: Essays on novelty production, niches and regimes in agriculture*. ISBN 90-232-3988-1

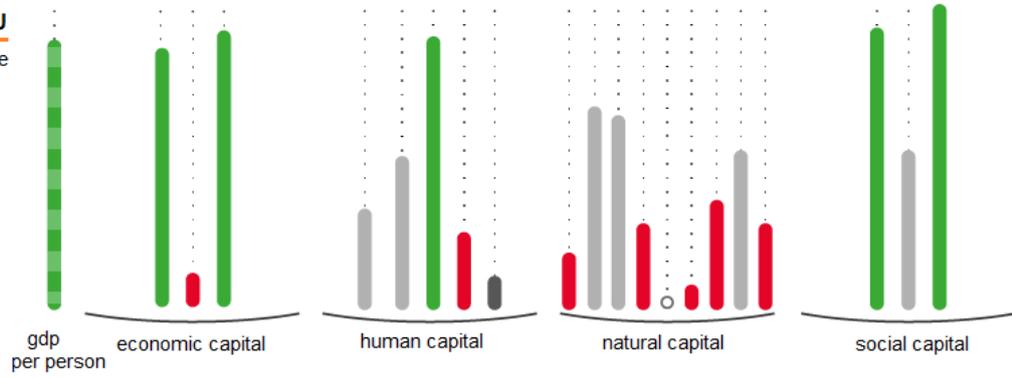
Zeemeijer, I. (2017). Miljarden voor topsectoren leveren nauwelijks baanbrekende innovaties op. *Financieel dagblad* 27/07/2017 <https://fd.nl/economie-politiek/1211523/miljarden-voor-topsectoren-leveren-nauwelijks-baanbrekende-innovaties-op>

## APPENDIX I

### Position in the EU

This figure shows the position of The Netherlands in the European Union per indicator.

- in top EU ranking
- middelposition
- low in EU ranking
- no data
- no color assigned



Source : CBS

Translated from CBS (2018)

Nature Inclusive Agriculture became a new buzz-word, but has similarities with the already existing policies under the name agricultural nature-conservation / -management (in Dutch: agrarisch natuurbeheer) (RMNO, 1998). The government indicates in various documents that it is time to change: transition agenda's, reports on Nature Inclusive Agriculture (NIA) measures & NIA in education. Both the NIA as described above and the RMNO (1998) publication emphasise: the recognition and use of ecological principles, integrated multi-functional land-use, diversity. The parliament's formal recognition of the importance of changes in agriculture, can be seen in the section on 'Living environment' in the Coalition agreement 2017-2021, which refers to the several transition agenda's (Regeerakkoord 2017-2021 p.46). In response to the growing attention for the loss of biodiversity in the Netherlands, the government presented the term 'Nature Inclusive Agriculture' (Erisman et al., 2017). Moreover, the Ministry of Economic Affairs assigned the task to the Louis Bolk institute and Wageningen Environmental Research to give a definition of NIA, create an overview of measures that farmers can take for nature inclusive agriculture on their farms and the effects of those measures and what this would require from the government (Erisman et al., 2017). This resulted in the three dimensions of nature-inclusive agriculture as presented in the table below. In 2017 when State secretary Van Dam (Ministry of Economic Affairs) informed the Dutch Parliament about the developments of Nature Inclusive Agriculture (NIA), he stated that he is not in the position to decide on the level of ambition (and facilitation) of the government for NIA and it was up to the new installed parliament to decide on this.

### Three dimensions of Nature-Inclusive Agriculture

1. At the basis of a nature-inclusive system is the biodiversity that makes essential contributions to farm management, such as natural disease and pest control, pollination, water supply and purification, natural soil fertility and good soil structure. This is called functional agrobiodiversity. Nature-inclusive agriculture starts with the maintenance, strengthening and use of this biodiversity and the services it offers to the company.
2. By closing cycles on the basis of these services, more efficient use can be made of raw materials and the negative influence of business operations on the (natural) environment - water, soil and air - becomes increasingly smaller. This creates opportunities for specific species on the farm and in the surrounding landscape.
3. Finally, there is concern for the landscape and specific species on the farm. Due to the construction and maintenance of landscape elements, a green infrastructure on farms is maintained. This is important for the flora and fauna in the agricultural area. Landscape elements in turn also have a function in strengthening the functional agrobiodiversity on the farm.

## APPENDIX III

<b>Interviews</b>	<b>date</b>	<b>organisation/function</b>
Remke	11/17/2017	Teacher aoc Citaverde Horst
Bart-Jan	12/7/2017	Agrovista agricultural real-estate broker
Hans	4/30/2017	Veterinarian
Maria	3/9/2017	Rikilt research (WUR)
Heleentje	7/18/2017	Nordwin sustainability coordinator
Rob	9/27/2017	WUR plant research
Geert	10/13/2017	Teacher AOC (expert-team)
Michal	6/29/2017	Groenhorst sustainability coordinator
Hens	10/30/2017	Affiliate Professor Nature Inclusive Agriculture WUR
Anne	4/29/2017	Stichting Living Lab natuurinclusieve landbouw
Gidi	10/24/2017	former WUR researcher
Annelies	6/29/2017	Clusius sustainability coordinator
Jan Hulsen	11/3/2017	Vet-vice en auteur koe-signalen
Esther	10/9/2017	Teacher AOC (expert-team)
Ab Groen	11/20/2017	Director Helicon / AOC-council / former WUR key-figure
Nout van de Vaart	7/29/2018	Hivos expert on agricultural policies
Godert Wytema	7/28/2018	Former AOC – Warmonderhof – HBO student, perma-culture
Harmen Riphagen	8/1/2018	Farm inspector for the Government's NVWA
<b>Participatory research</b>	<b>date</b>	<b>organisation/function</b>
Dairy farmers at Movie-W docu	11/8/2017	Farmers concerned / WUR researcher + PHD / civil society
Natural Livestock Farming group	Apr-May-2017	Farmers - Veterinarians - NGO workers - Researcher
Debate Veetelers	6/13/2017	Animal science students - NLF - WUR lecturer Kees v Veluw
DOTduurzaAOCs	11/8/2017	Aeres + various AOCs + AOC-council
dialogue Wageningen debating	11/13/2017	Animal Science Group
Sustainability at the Farm	3/15/2018	Wageningen Campus Connect
Resilience symposium ASG	12/19/2017	Van der Peet, 2017 WUR Resilience Symposium, 2017
NLF conference 2018	3/8/2018	Natural Livestock Farming
<b>Informants from field</b>	<b>date</b>	<b>organisation/function</b>
A H Kaasjager	12/12/2017	former Farmer / board member productschap milk
Pieter	11/9/2017	Dairy farmers and owner of cheese factory, Remeker
Teus	11/19/2017	Farm worker at various (conventional) dairy farms
Jan Wieringa	4/9/2018	Veld & Beek Community Supported, bio dynamic dairy farm
Erik Toussaint	3/27/2018	Plant Research Institute WUR. at 'Cutting across the Silos'
Van der Peet	12/19/2017	WUR Resilience Symposium, 2017
Rik van der Kooij	3/29/2017	Manager of Agro farm shop. phone call

## APPENDIX IV

## ATLAS.ti Cooccurring Codes

---

HU: gecodeerd op rules & knowledge - pressure - initiatives

File: [\\wurnet.nl\homes\meer048\My Docu...\gecodeerd op rules & knowledge - pressure - initiatives.hpr7]

Edited by: Super

Date/Time: 2018-03-14 16:31:24

---

Codes: 31

---

### **agri-business {10-0} [10]**

- alignment {14-0} [3]
  - challenge {115-0} [3]
  - educational regime {86-0} [2]
  - initiatives / transformative experiments {82-0} [2]
  - knowledge in practice at farm {57-0} [2]
  - protocols/procedures {18-0} [2]
  - role/expectations/authority {17-0} [1]
  - values/norms {76-0} [2]
  - Whole School Approach {12-0} [2]
  - windows of opportunities {38-0} [4]
- 

### **alignment {14-0} [12]**

- agri-business {10-0} [3]
- challenge {115-0} [1]
- define sustainable / natural / NIA {13-0} [2]
- educational regime {86-0} [1]
- inclusion {20-0} [1]
- initiatives / transformative experiments {82-0} [4]
- knowledge in practice at farm {57-0} [4]

protocols/procedures {18-0} [2]  
regulative rules {79-0} [2]  
socio-cognitive {82-0} [5]  
Whole School Approach {12-0} [6]  
windows of opportunities {38-0} [6]

---

**anti-biotics {9-0} [14]**

anticipation {10-0} [1]  
bodies of knowledge/beliefs {86-0} [2]  
challenge {115-0} [3]  
funding {35-0} [3]  
initiatives / transformative experiments {82-0} [2]  
incentive structure {37-0} [2]  
knowledge in practice at farm {57-0} [2]  
Landscape pressure {27-0} [2]  
problem agenda {35-0} [2]  
protocols/procedures {18-0} [2]  
reflexive {4-0} [1]  
science regime cooperation {48-0} [4]  
socio-cognitive {82-0} [2]  
values/norms {76-0} [1]

---

**anticipation {10-0} [18]**

anti-biotics {9-0} [1]  
bodies of knowledge/beliefs {86-0} [6]  
challenge {115-0} [2]  
educational regime {86-0} [2]  
funding {35-0} [2]  
inclusion {20-0} [3]  
initiatives / transformative experiments {82-0} [8]  
incentive structure {37-0} [2]  
knowledge in practice at farm {57-0} [2]  
Landscape pressure {27-0} [4]

problem agenda {35-0} [4]  
reflexive {4-0} [2]  
regulative rules {79-0} [6]  
responsiveness {7-0} [1]  
role/expectations/authority {17-0} [4]  
socio-cognitive {82-0} [4]  
specialist / generalist {14-0} [5]  
values/norms {76-0} [3]

---

**bodies of knowledge/beliefs {86-0} [22]**

anti-biotics {9-0} [2]  
anticipation {10-0} [6]  
challenge {115-0} [49]  
educational regime {86-0} [30]  
funding {35-0} [19]  
inclusion {20-0} [8]  
initiatives / transformative experiments {82-0} [34]  
incentive structure {37-0} [15]  
knowledge in practice at farm {57-0} [31]  
Landscape pressure {27-0} [6]  
priorities {20-0} [4]  
problem agenda {35-0} [16]  
protocols/procedures {18-0} [6]  
regulative rules {79-0} [29]  
responsiveness {7-0} [2]  
role/expectations/authority {17-0} [5]  
science regime cooperation {48-0} [24]  
socio-cognitive {82-0} [25]  
specialist / generalist {14-0} [11]  
values/norms {76-0} [31]  
Whole School Approach {12-0} [2]  
windows of opportunities {38-0} [10]

---

**challenge {115-0} [26]**

agri-business {10-0} [3]  
alignment {14-0} [1]  
anti-biotics {9-0} [3]  
anticipation {10-0} [2]  
bodies of knowledge/beliefs {86-0} [49]  
define sustainable / natural / NIA {13-0} [4]  
educational regime {86-0} [43]  
expectations {3-0} [2]  
funding {35-0} [24]  
inclusion {20-0} [4]  
initiatives / transformative experiments {82-0} [31]  
incentive structure {37-0} [19]  
knowledge in practice at farm {57-0} [22]  
Landscape pressure {27-0} [11]  
priorities {20-0} [6]  
problem agenda {35-0} [24]  
protocols/procedures {18-0} [14]  
reflexive {4-0} [1]  
regulative rules {79-0} [37]  
role/expectations/authority {17-0} [5]  
science regime cooperation {48-0} [30]  
socio-cognitive {82-0} [48]  
specialist / generalist {14-0} [13]  
values/norms {76-0} [32]  
Whole School Approach {12-0} [6]  
windows of opportunities {38-0} [14]

---

**define sustainable / natural / NIA {13-0} [12]**

alignment {14-0} [2]  
challenge {115-0} [4]  
educational regime {86-0} [3]  
inclusion {20-0} [2]  
initiatives / transformative experiments {82-0} [3]

incentive structure {37-0} [5]  
Landscape pressure {27-0} [2]  
problem agenda {35-0} [2]  
regulative rules {79-0} [6]  
socio-cognitive {82-0} [2]  
values/norms {76-0} [6]  
windows of opportunities {38-0} [1]

---

**educational regime {86-0} [24]**

agri-business {10-0} [2]  
alignment {14-0} [1]  
anticipation {10-0} [2]  
bodies of knowledge/beliefs {86-0} [30]  
challenge {115-0} [43]  
define sustainable / natural / NIA {13-0} [3]  
expectations {3-0} [2]  
funding {35-0} [6]  
inclusion {20-0} [4]  
initiatives / transformative experiments {82-0} [28]  
incentive structure {37-0} [5]  
knowledge in practice at farm {57-0} [24]  
priorities {20-0} [5]  
problem agenda {35-0} [6]  
reflexive {4-0} [2]  
regulative rules {79-0} [25]  
responsiveness {7-0} [2]  
role/expectations/authority {17-0} [2]  
science regime cooperation {48-0} [14]  
socio-cognitive {82-0} [26]  
specialist / generalist {14-0} [3]  
values/norms {76-0} [5]  
Whole School Approach {12-0} [2]  
windows of opportunities {38-0} [19]

---

**expectations {3-0} [4]**

- challenge {115-0} [2]
  - educational regime {86-0} [2]
  - reflexive {4-0} [1]
  - values/norms {76-0} [1]
- 

**funding {35-0} [21]**

- anti-biotics {9-0} [3]
  - anticipation {10-0} [2]
  - bodies of knowledge/beliefs {86-0} [19]
  - challenge {115-0} [24]
  - educational regime {86-0} [6]
  - inclusion {20-0} [4]
  - initiatives / transformative experiments {82-0} [8]
  - incentive structure {37-0} [8]
  - knowledge in practice at farm {57-0} [6]
  - Landscape pressure {27-0} [2]
  - priorities {20-0} [5]
  - problem agenda {35-0} [15]
  - R: Nouja dat heet dan vanuit W.. {1-0} [2]
  - reflexive {4-0} [2]
  - regulative rules {79-0} [13]
  - role/expectations/authority {17-0} [2]
  - science regime cooperation {48-0} [9]
  - socio-cognitive {82-0} [15]
  - specialist / generalist {14-0} [4]
  - values/norms {76-0} [8]
  - windows of opportunities {38-0} [7]
- 

**inclusion {20-0} [22]**

- alignment {14-0} [1]
- anticipation {10-0} [3]

bodies of knowledge/beliefs {86-0} [8]  
challenge {115-0} [4]  
define sustainable / natural / NIA {13-0} [2]  
educational regime {86-0} [4]  
funding {35-0} [4]  
initiatives / transformative experiments {82-0} [19]  
incentive structure {37-0} [4]  
knowledge in practice at farm {57-0} [6]  
Landscape pressure {27-0} [5]  
priorities {20-0} [2]  
problem agenda {35-0} [12]  
reflexive {4-0} [2]  
regulative rules {79-0} [13]  
responsiveness {7-0} [7]  
role/expectations/authority {17-0} [4]  
science regime cooperation {48-0} [11]  
socio-cognitive {82-0} [14]  
specialist / generalist {14-0} [5]  
values/norms {76-0} [6]  
Whole School Approach {12-0} [2]

---

**initiatives / transformative experiments {82-0} [26]**

agri-business {10-0} [2]  
alignment {14-0} [4]  
anti-biotics {9-0} [2]  
anticipation {10-0} [8]  
bodies of knowledge/beliefs {86-0} [34]  
challenge {115-0} [31]  
define sustainable / natural / NIA {13-0} [3]  
educational regime {86-0} [28]  
funding {35-0} [8]  
inclusion {20-0} [19]  
incentive structure {37-0} [14]  
knowledge in practice at farm {57-0} [23]

Landscape pressure {27-0} [8]  
priorities {20-0} [2]  
problem agenda {35-0} [13]  
protocols/procedures {18-0} [5]  
reflexive {4-0} [4]  
regulative rules {79-0} [42]  
responsiveness {7-0} [5]  
role/expectations/authority {17-0} [4]  
science regime cooperation {48-0} [12]  
socio-cognitive {82-0} [44]  
specialist / generalist {14-0} [2]  
values/norms {76-0} [15]  
Whole School Approach {12-0} [3]  
windows of opportunities {38-0} [13]

---

**incentive structure {37-0} [20]**

anti-biotics {9-0} [2]  
anticipation {10-0} [2]  
bodies of knowledge/beliefs {86-0} [15]  
challenge {115-0} [19]  
define sustainable / natural / NIA {13-0} [5]  
educational regime {86-0} [5]  
funding {35-0} [8]  
inclusion {20-0} [4]  
initiatives / transformative experiments {82-0} [14]  
knowledge in practice at farm {57-0} [6]  
Landscape pressure {27-0} [6]  
problem agenda {35-0} [8]  
protocols/procedures {18-0} [4]  
reflexive {4-0} [2]  
regulative rules {79-0} [21]  
science regime cooperation {48-0} [8]  
socio-cognitive {82-0} [10]  
specialist / generalist {14-0} [1]

values/norms {76-0} [18]

windows of opportunities {38-0} [4]

---

### **knowledge in practice at farm {57-0} [22]**

agri-business {10-0} [2]

alignment {14-0} [4]

anti-biotics {9-0} [2]

anticipation {10-0} [2]

bodies of knowledge/beliefs {86-0} [31]

challenge {115-0} [22]

educational regime {86-0} [24]

funding {35-0} [6]

inclusion {20-0} [6]

initiatives / transformative experiments {82-0} [23]

incentive structure {37-0} [6]

Landscape pressure {27-0} [3]

problem agenda {35-0} [7]

protocols/procedures {18-0} [3]

reflexive {4-0} [1]

regulative rules {79-0} [15]

responsiveness {7-0} [1]

science regime cooperation {48-0} [14]

socio-cognitive {82-0} [16]

specialist / generalist {14-0} [3]

values/norms {76-0} [13]

windows of opportunities {38-0} [8]

---

### **Landscape pressure {27-0} [20]**

anti-biotics {9-0} [2]

anticipation {10-0} [4]

bodies of knowledge/beliefs {86-0} [6]

challenge {115-0} [11]

define sustainable / natural / NIA {13-0} [2]

funding {35-0} [2]  
inclusion {20-0} [5]  
initiatives / transformative experiments {82-0} [8]  
incentive structure {37-0} [6]  
knowledge in practice at farm {57-0} [3]  
priorities {20-0} [3]  
problem agenda {35-0} [8]  
protocols/procedures {18-0} [2]  
regulative rules {79-0} [27]  
responsiveness {7-0} [5]  
science regime cooperation {48-0} [3]  
socio-cognitive {82-0} [9]  
specialist / generalist {14-0} [7]  
values/norms {76-0} [17]  
windows of opportunities {38-0} [4]

---

**priorities {20-0} [19]**

bodies of knowledge/beliefs {86-0} [4]  
challenge {115-0} [6]  
educational regime {86-0} [5]  
funding {35-0} [5]  
inclusion {20-0} [2]  
initiatives / transformative experiments {82-0} [2]  
Landscape pressure {27-0} [3]  
problem agenda {35-0} [5]  
protocols/procedures {18-0} [2]  
R: Nouja dat heet dan vanuit W.. {1-0} [4]  
reflexive {4-0} [2]  
regulative rules {79-0} [10]  
role/expectations/authority {17-0} [2]  
science regime cooperation {48-0} [5]  
socio-cognitive {82-0} [7]  
specialist / generalist {14-0} [2]  
values/norms {76-0} [4]

Whole School Approach {12-0} [1]  
windows of opportunities {38-0} [4]

---

**problem agenda {35-0} [23]**

anti-biotics {9-0} [2]  
anticipation {10-0} [4]  
bodies of knowledge/beliefs {86-0} [16]  
challenge {115-0} [24]  
define sustainable / natural / NIA {13-0} [2]  
educational regime {86-0} [6]  
funding {35-0} [15]  
inclusion {20-0} [12]  
initiatives / transformative experiments {82-0} [13]  
incentive structure {37-0} [8]  
knowledge in practice at farm {57-0} [7]  
Landscape pressure {27-0} [8]  
priorities {20-0} [5]  
protocols/procedures {18-0} [5]  
reflexive {4-0} [2]  
regulative rules {79-0} [16]  
responsiveness {7-0} [3]  
role/expectations/authority {17-0} [2]  
science regime cooperation {48-0} [15]  
socio-cognitive {82-0} [19]  
specialist / generalist {14-0} [7]  
values/norms {76-0} [13]  
windows of opportunities {38-0} [2]

---

**protocols/procedures {18-0} [16]**

agri-business {10-0} [2]  
alignment {14-0} [2]  
anti-biotics {9-0} [2]  
bodies of knowledge/beliefs {86-0} [6]

challenge {115-0} [14]  
initiatives / transformative experiments {82-0} [5]  
incentive structure {37-0} [4]  
knowledge in practice at farm {57-0} [3]  
Landscape pressure {27-0} [2]  
priorities {20-0} [2]  
problem agenda {35-0} [5]  
regulative rules {79-0} [8]  
science regime cooperation {48-0} [7]  
socio-cognitive {82-0} [4]  
values/norms {76-0} [6]  
windows of opportunities {38-0} [6]

---

**R: Nouja dat heet dan vanuit W.. {1-0} [5]**

funding {35-0} [2]  
priorities {20-0} [4]  
science regime cooperation {48-0} [2]  
socio-cognitive {82-0} [1]  
windows of opportunities {38-0} [1]

---

**reflexive {4-0} [12]**

anti-biotics {9-0} [1]  
anticipation {10-0} [2]  
challenge {115-0} [1]  
educational regime {86-0} [2]  
expectations {3-0} [1]  
funding {35-0} [2]  
inclusion {20-0} [2]  
initiatives / transformative experiments {82-0} [4]  
incentive structure {37-0} [2]  
knowledge in practice at farm {57-0} [1]  
priorities {20-0} [2]  
problem agenda {35-0} [2]

---

**regulative rules {79-0} [21]**

alignment {14-0} [2]  
anticipation {10-0} [6]  
bodies of knowledge/beliefs {86-0} [29]  
challenge {115-0} [37]  
define sustainable / natural / NIA {13-0} [6]  
educational regime {86-0} [25]  
funding {35-0} [13]  
inclusion {20-0} [13]  
initiatives / transformative experiments {82-0} [42]  
incentive structure {37-0} [21]  
knowledge in practice at farm {57-0} [15]  
Landscape pressure {27-0} [27]  
priorities {20-0} [10]  
problem agenda {35-0} [16]  
protocols/procedures {18-0} [8]  
role/expectations/authority {17-0} [4]  
science regime cooperation {48-0} [16]  
socio-cognitive {82-0} [35]  
specialist / generalist {14-0} [5]  
values/norms {76-0} [25]  
windows of opportunities {38-0} [8]

---

**responsiveness {7-0} [13]**

anticipation {10-0} [1]  
bodies of knowledge/beliefs {86-0} [2]  
educational regime {86-0} [2]  
inclusion {20-0} [7]  
initiatives / transformative experiments {82-0} [5]  
knowledge in practice at farm {57-0} [1]  
Landscape pressure {27-0} [5]  
problem agenda {35-0} [3]

role/expectations/authority {17-0} [2]  
science regime cooperation {48-0} [2]  
socio-cognitive {82-0} [5]  
specialist / generalist {14-0} [1]  
windows of opportunities {38-0} [1]

---

**role/expectations/authority {17-0} [16]**

agri-business {10-0} [1]  
anticipation {10-0} [4]  
bodies of knowledge/beliefs {86-0} [5]  
challenge {115-0} [5]  
educational regime {86-0} [2]  
funding {35-0} [2]  
inclusion {20-0} [4]  
initiatives / transformative experiments {82-0} [4]  
priorities {20-0} [2]  
problem agenda {35-0} [2]  
regulative rules {79-0} [4]  
responsiveness {7-0} [2]  
science regime cooperation {48-0} [4]  
socio-cognitive {82-0} [5]  
specialist / generalist {14-0} [4]  
Whole School Approach {12-0} [2]

---

**science regime cooperation {48-0} [21]**

anti-biotics {9-0} [4]  
bodies of knowledge/beliefs {86-0} [24]  
challenge {115-0} [30]  
educational regime {86-0} [14]  
funding {35-0} [9]  
inclusion {20-0} [11]  
initiatives / transformative experiments {82-0} [12]  
incentive structure {37-0} [8]

knowledge in practice at farm {57-0} [14]  
Landscape pressure {27-0} [3]  
priorities {20-0} [5]  
problem agenda {35-0} [15]  
protocols/procedures {18-0} [7]  
R: Nouja dat heet dan vanuit W.. {1-0} [2]  
regulative rules {79-0} [16]  
responsiveness {7-0} [2]  
role/expectations/authority {17-0} [4]  
socio-cognitive {82-0} [27]  
specialist / generalist {14-0} [7]  
values/norms {76-0} [14]  
windows of opportunities {38-0} [3]

---

#### **socio-cognitive {82-0} [25]**

alignment {14-0} [5]  
anti-biotics {9-0} [2]  
anticipation {10-0} [4]  
bodies of knowledge/beliefs {86-0} [25]  
challenge {115-0} [48]  
define sustainable / natural / NIA {13-0} [2]  
educational regime {86-0} [26]  
funding {35-0} [15]  
inclusion {20-0} [14]  
initiatives / transformative experiments {82-0} [44]  
incentive structure {37-0} [10]  
knowledge in practice at farm {57-0} [16]  
Landscape pressure {27-0} [9]  
priorities {20-0} [7]  
problem agenda {35-0} [19]  
protocols/procedures {18-0} [4]  
R: Nouja dat heet dan vanuit W.. {1-0} [1]  
regulative rules {79-0} [35]  
responsiveness {7-0} [5]

role/expectations/authority {17-0} [5]  
science regime cooperation {48-0} [27]  
specialist / generalist {14-0} [7]  
values/norms {76-0} [25]  
Whole School Approach {12-0} [4]  
windows of opportunities {38-0} [11]

---

**specialist / generalist {14-0} [19]**

anticipation {10-0} [5]  
bodies of knowledge/beliefs {86-0} [11]  
challenge {115-0} [13]  
educational regime {86-0} [3]  
funding {35-0} [4]  
inclusion {20-0} [5]  
initiatives / transformative experiments {82-0} [2]  
incentive structure {37-0} [1]  
knowledge in practice at farm {57-0} [3]  
Landscape pressure {27-0} [7]  
priorities {20-0} [2]  
problem agenda {35-0} [7]  
regulative rules {79-0} [5]  
responsiveness {7-0} [1]  
role/expectations/authority {17-0} [4]  
science regime cooperation {48-0} [7]  
socio-cognitive {82-0} [7]  
values/norms {76-0} [6]  
windows of opportunities {38-0} [2]

---

**values/norms {76-0} [23]**

agri-business {10-0} [2]  
anti-biotics {9-0} [1]  
anticipation {10-0} [3]  
bodies of knowledge/beliefs {86-0} [31]

challenge {115-0} [32]  
define sustainable / natural / NIA {13-0} [6]  
educational regime {86-0} [5]  
expectations {3-0} [1]  
funding {35-0} [8]  
inclusion {20-0} [6]  
initiatives / transformative experiments {82-0} [15]  
incentive structure {37-0} [18]  
knowledge in practice at farm {57-0} [13]  
Landscape pressure {27-0} [17]  
priorities {20-0} [4]  
problem agenda {35-0} [13]  
protocols/procedures {18-0} [6]  
regulative rules {79-0} [25]  
science regime cooperation {48-0} [14]  
socio-cognitive {82-0} [25]  
specialist / generalist {14-0} [6]  
Whole School Approach {12-0} [4]  
windows of opportunities {38-0} [9]

---

#### **Whole School Approach {12-0} [12]**

agri-business {10-0} [2]  
alignment {14-0} [6]  
bodies of knowledge/beliefs {86-0} [2]  
challenge {115-0} [6]  
educational regime {86-0} [2]  
inclusion {20-0} [2]  
initiatives / transformative experiments {82-0} [3]  
priorities {20-0} [1]  
role/expectations/authority {17-0} [2]  
socio-cognitive {82-0} [4]  
values/norms {76-0} [4]  
windows of opportunities {38-0} [1]

---

## **windows of opportunities {38-0} [22]**

agri-business {10-0} [4]  
alignment {14-0} [6]  
bodies of knowledge/beliefs {86-0} [10]  
challenge {115-0} [14]  
define sustainable / natural / NIA {13-0} [1]  
educational regime {86-0} [19]  
funding {35-0} [7]  
initiatives / transformative experiments {82-0} [13]  
incentive structure {37-0} [4]  
knowledge in practice at farm {57-0} [8]  
Landscape pressure {27-0} [4]  
priorities {20-0} [4]  
problem agenda {35-0} [2]  
protocols/procedures {18-0} [6]  
R: Nouja dat heet dan vanuit W.. {1-0} [1]  
regulative rules {79-0} [8]  
responsiveness {7-0} [1]  
science regime cooperation {48-0} [3]  
socio-cognitive {82-0} [11]  
specialist / generalist {14-0} [2]  
values/norms {76-0} [9]  
Whole School Approach {12-0} [1]

---