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Multiple perspectives on dynamics of participation and learning in sustainable farming initiatives

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Laure Triste

Summary

Sustainable development is a complex concept. Nevertheless, public and private initiatives emerge to support farmers in the sustainable development of their farming practices. The emergence of these sustainable farming initiatives (SFIs) must be understood against the background of multiple evolutions in society and research. Amongst others, important evolutions are: the complex and normative nature of the concept of sustainable development, the change towards a systemic perspective on knowledge creation and extension in agriculture, and the resulting re-orientation of researchers from being a knowledge source to being a knowledge co-creator. As also experienced in our own research group, adoption of new roles by researchers requires a learning process. In particular, with the aim to define sustainability for Flemish agriculture, we experienced a poor adoption of a sustainability assessment tool in agricultural practice. This experience and the evaluation of the development process of this sustainability assessment tool, set the scene for current dissertation (Chapter 3).

The rationale of this dissertation stems from the observation that SFIs vary considerably in their success to actually support farmers in on-farm sustainable development. In our research, we are interested in how they can succeed in this matter. In Chapter 1, we elaborate on the relation between participation and learning in the context of sustainable development. This supports our research focus on those SFIs in which farmer participation goes further than the mere adoption of directed sustainable farming measures. This means that these SFIs try to engage their participants into a richer learning process, that goes further than task-oriented problem solving and allows to question the assumptions underlying their actions. Specific challenges are related to these SFIs. A first challenge results from the lack of a fixed blueprint for SFI design and the considerable variation in success between existing SFIs. This causes a challenge for SFI initiators and organizers to design an SFI that successfully supports on-farm sustainable development by engaging farmers to participate. A second challenge is related to the observation that learning in SFIs is required on different, but interrelated, accounts. Learning is required both on how to define sustainable farming in a given context and on the development of a successful SFI in this given context. A third challenge is that SFIs require learning of all participating actors, including farmers, SFI initiators and organizers, and researchers.

Based on these challenges, our research objective is to reveal key characteristics of SFI design by investigating the dynamical interrelations that can facilitate the learning of participating farmers in an SFI and of the SFI as a whole. To accomplish this objective, we explored three main research questions (RQ): *RQ 1. How can we understand and*

investigate the dynamical interactions between the learning of participating farmers and the learning of the SFI?; RQ 2. What are relevant dynamical interactions at play between participating farmers and the SFI?; RQ3. What are key dynamics and characteristics for SFI design that successfully facilitate farmers' learning for on-farm sustainable development?

In Chapter 2, we address our first research question, in which we build our research approach that enables to investigate the dynamical interactions in an SFI related to participation and learning. First, we stipulated three levels that can aid us to understand the dynamics at play in an SFI: the level of the individual, the level of the SFI and the context level. Second, we present three perspectives and frameworks that can help us to answer RQ 2. These perspectives each use a different entry point to understand the dynamics at play in an SFI. The perspectives are Self-Determination Theory (SDT; Ryan and Deci, 2000b), Communities of Practice (CoP; Wenger *et al*., 2002) and the Value Creation Framework (VCF; Wenger *et al*., 2011), and Cultural-Historical Activity Theory (CHAT; Engeström, 1987). Third, we present a research perspective based on Practice Theory to answer RQ 3. This latter perspective allows to take into account the complexity related to participatory processes and learning, and to articulate the findings resulting from RQ 2.

We first address RQ 2, and performed empirical research using three different cases of SFIs and the three perspectives SDT, CoP and CHAT.

First, in Chapter 4, we use the perspective of Self-Determination Theory (SDT) to investigate farmer motivation to participate in Veldleeuwerik (an existing SFI in The Netherlands). SDT takes the individual farmer as an entry point to investigate the dynamics related to participation, but does not neglect the interaction with characteristics of the SFI. SDT states that different motivation types can differ in quality regarding the persistence and quality of a behavior. Therefore, to obtain the richer learning required for sustainable development, farmers preferably are autonomously motivated to participate in the SFI. This means that they personally endorse their participation and have a feeling of freedom of choice regarding their participation. We found that the farmers' motives to participate are directed by a diversity of underlying motivational processes (both autonomous and controlled), but that specific characteristics in the SFI design can contribute the creation of autonomous motivation, by addressing the basic psychological needs of autonomy, competence and relatedness.

Second, in Chapter 5, we use the CoP-perspective and VCF-perspective to investigate how farmers value their participation in different types of activities in an SFI. The research in this Chapter thus takes the social interactions in which the farmers participate in the SFI as an entry point. Our cases for this research are the Flemish and Northern Irish

regional networks of the DAIRYMAN-project, a finished SFI spread over 10 regions in North West Europe. Our results show that different types of activities differently contribute to the perceived value creation for farmers. Specifically, we found two equally important and complementary types of knowledge creation activities: activities based on farmer group-advisor interactions and activities based on individual farmer-researcher-advisor interactions.

Third, in Chapter 6, we used CHAT (Engeström, 1987) to understand the development towards an established SFI. Using this perspective, we took a systems perspective on SFIs as entry point. We compared the developmental history of an established (Veldleeuwerik, The Netherlands) and a finished SFI (Beloftevol Boeren, Flanders), to understand their differences in success to develop into an durable and recognized SFI. Our research indicates the importance of the developmental history and the context situation for the development of SFIs, as they define the potential directions for future SFI development. Further, contradictions within the SFI can either act as a driving force for development or result in lowered activity and development when the SFI fails to overcome these contradictions. Further, our research indicates the relevance of the learning at SFI level for the support of farmer learning on on-farm sustainable development. This is because the interpretation and meaning making on sustainable development at SFI level inevitably penetrates into the learning and meaning making of the individual farmers through participation in the SFI's activities.

After this empirical research, we reflected on both our outcomes and our research approach in Chapter 7. Chapter 7 contains two main sections. In the first section, we aim to answer our third research question: *What are key dynamics and characteristics for SFI design that successfully facilitate farmers' learning for on-farm sustainable development?* To do so, we articulate our findings from Chapter 4 to 6 using a practice-based approach (PBA). Using this PBA, we describe an SFI as a practice that emerges through the interplay of four components: routinized activities, human agency, material-functional structure and socio-cultural structure. Translating our research question into this PBA-terminology, we are thus mainly interested in the farmers' agency to participate in the learning activities of the SFI, and how the other PBA-components can contribute to this agency. This analysis shows the importance of the farmers' motivational orientation, the provision of a basic needs fulfilling context, the organisation of complementary group and individual farmer learning activities, the historical development of the SFI practice and the dispositions, practices and expectations of external actors.

In the second section of Chapter 7, we discuss the perspectives we used in our research and our overall research approach, and conclude with four suggestions for further research.

First, we suggest to investigate the influence of the broader societal, political and cultural context on the performance of the activities in the initiatives, and vice versa, how the outcomes of the learning processes in the initiatives penetrate into the broader societal context. Second, we suggest to scrutinize how participants learn while participating in the initiatives, i.e., the discursive processes that define the farmers' learning process. Third, we suggest to investigate the required dispositions and competencies of the actors engaged in the initiatives. Fourth, we question the influence of farmer participation in SFIs on the actual implementation and adoption of sustainable farming practices on the farm.

In Chapter 8, we translate our results into practical recommendation for SFI design, targeted at actors involved in the design or development of (future) SFIs. To attract and stimulate farmer participation we advise to: (i) use incentives, like rewards, to attract farmers who are not inherently motivated to participate in an initiative; and (ii) to create an environment that contributes to the satisfaction of farmers' basic needs of autonomy, competence and relatedness, e.g., by providing decision-making power to farmers, offering opportunities for knowledge exchange on sustainable development, and stimulating frequent interactions with important others. To create a rich value pallette for farmers, we advise to complementary organize group activities for knowledge creation on sustainable development and individual farmer activities that generate farm specific knowledge. Further, we recommend to organize these activities on locations that provide first-hand experiences for farmers, e.g., farms, sites of chain actors, experimental farms or field trials. To stimulate the beneficial interaction between the learning at the level of the farmers and the learning at the level of the SFI, we advise to stimulate farmers' involvement in the development and learning processes at the initiative level, e.g., through the organization of a bottom-up approach or knowledge dissemination throughout the SFI. Further regarding stakeholder involvement and representation in the SFI, we advise to (i) involve a broad diversity of stakeholders from the start and also within the governing bodies of the SFI, as it contributes to the learning and developmental opportunities of the SFI, and (ii) to organize regular encounters between the SFI and a wider stakeholder group to align and embed the initiative in the agri-food system.

Samenvatting

Duurzame ontwikkeling in de landbouw is een complex gegeven. Toch worden verschillende publieke en private initiatieven opgezet die landbouwers willen ondersteunen in de duurzame ontwikkeling van hun landbouwpraktijken. Het ontstaan van deze initiatieven voor de verduurzaming van landbouwpraktijken (SFI; Sustainable Farming Initiatives) moet gezien worden in een context van verschillende evoluties in de samenleving en in onderzoek. Belangrijke evoluties zijn onder meer: de complexe en normatieve aard van het concept 'duurzame ontwikkeling', de evolutie in de richting van een systemisch perspectief op kenniscreatie en advisering in de landbouw, en de hieruit volgende re-oriëntatie van de rol van onderzoekers van kennisbron naar kennis co-creator. Zoals we zelf konden ervaren in onze onderzoeksgroep vereist de adoptie van deze nieuwe rol door onderzoekers een leerproces. Bijvoorbeeld, in ons streven om duurzaamheid voor de Vlaamse landbouw te definiëren, kregen we te maken met een gebrekkige adoptie van een duurzaamheidsbeoordelingsinstrument in de landbouwpraktijk. Deze ervaring en de evaluatie van het ontwikkelingsproces van dat duurzaamheidsbeoordelingsinstrument motiveerden ons om dit onderzoek uit te voeren (Hoofdstuk 3).

De rationale van dit onderzoek komt voort uit de observatie dat SFIs aanzienlijk kunnen verschillen in hun succes om daadwerkelijk landbouwers te ondersteunen in de duurzame ontwikkeling van hun bedrijf. In ons onderzoek zijn we geïnteresseerd in hoe SFIs hierin slagen. In Hoofdstuk 1 gaan we in op de relatie tussen participatie en leren in de context van duurzame ontwikkeling. Deze uiteenzetting ondersteunt onze focus op SFIs waarin participatie door landbouwers verder gaat dan louter de adoptie van opgelegde duurzaamheidsmaatregelen. Dit betekent dat deelnemers van een SFI betrokken worden in een rijker leerproces dat verder gaat dan taakgericht oplossen van problemen in hun acties, maar ook de onderliggende veronderstellingen van hun acties in vraag stelt. Er blijken echter enkele uitdagingen gekoppeld te zijn aan dergelijke SFIs. Ten eerste, het gebrek aan een vaste handleiding voor het ontwerp van SFIs en de aanzienlijke variatie in hun succes vormt een uitdaging voor SFI initiators en organisatoren om een SFI te ontwerpen dat op een succesvolle manier duurzame ontwikkeling op het landbouwbedrijf ondersteunt. Een tweede uitdaging komt voort uit de observatie dat leren nodig is op verschillende, maar aan elkaar gerelateerde manieren. Leren is nodig over hoe duurzame landbouw kan gedefinieerd worden in een gegeven context, maar ook over hoe een succesvol SFI kan ontwikkeld worden in een gegeven context. Ten derde, SFIs vereisen dat alle deelnemende actoren leren, inclusief landbouwers, SFI initiators en organisatoren en onderzoekers.

Op basis van deze uitdagingen, definiëren we het doel van ons onderzoek als: het blootleggen van belangrijke eigenschappen van een SFI door de verschillende dynamieken te onderzoeken die leren van landbouwers en het SFI in zijn geheel faciliteren. Om dit doel te verwezenlijken, onderzoeken we drie grote onderzoeksvragen (OV). *OV1. Hoe kunnen we de dynamieken tussen leren van de deelnemende landbouwers en het leren van een SFI begrijpen en onderzoeken?; OV2. Wat zijn de relevante dynamieken die spelen tussen de deelnemende landbouwers en het SFI?; OV3. Wat zijn de belangrijke dynamieken en karakteristieken van een SFI, die op een succesvolle manier leren voor een duurzame ontwikkeling van het landbouwbedrijf kunnen faciliteren?*

In Hoofdstuk 2 komen we tegemoet aan onze eerste onderzoeksvraag, en onderbouwen we onze onderzoeksaanpak om de dynamische interacties die gerelateerd zijn aan participatie en leren in een SFI te onderzoeken. Ten eerste, wijzen we op drie niveaus die ons kunnen helpen om de dynamieken in een SFI te begrijpen: het niveau van het individu, het niveau van het SFI en het niveau van de context. Ten tweede, presenteren we drie perspectieven en kaders die ons kunnen helpen om OV2 te beantwoorden. Elk perspectief gebruikt een ander ingangspunt om de dynamieken in een SFI te vatten. De perspectieven zijn zelfdeterminatietheorie (SDT; Ryan and Deci, 2000b), theorie van *Communities of Practice* (CoP; Wenger et al. 2002) en Cultural-Historical Activity Theory (CHAT; Engeström, 1987). Ten derde, presenteren we een onderzoeksperspectief gebaseerd op praktijktheorie (PBA) dat ons toelaat om OV3 te beantwoorden. Dit perspectief laat toe om de complexiteit gerelateerd aan participatieve processen en leerprocessen te vatten, en de resultaten die uit het beantwoorden van OV2 voortkomen te articuleren.

Om OV2 te beantwoorden voerden we empirisch onderzoek uit op drie verschillende SFI casussen en de drie theoretische perspectieven SDT, CoP en CHAT.

Ten eerste, in Hoofdstuk 4, hanteren we het perspectief van de zelfdeterminatietheorie (SDT) om de motivatie van landbouwers voor participatie in Veldleeuwerik (een bestaand SFI in Nederland) te onderzoeken. SDT neemt de individuele landbouwer als ingangspunt om de dynamieken gerelateerd aan participatie te onderzoek, maar neemt ook de interactie met karakteristieken van het SFI mee. SDT gaat ervan uit dat verschillende types motivatie kunnen resulteren in verschillende kwaliteit en persistentie van een gedrag, in ons geval deelname aan SFIs. Om tot het diepere leren te komen dat nodig is voor duurzame ontwikkeling, hebben landbouwers bij voorkeur een autonome motivatie om deel te nemen aan het SFI. Dit betekent dat ze participatie in het SFI persoonlijk onderschrijven en een gevoel van vrijheid hebben in hun keuzes omtrent hun deelname. We vonden dat motieven van landbouwers om deel te nemen aan een SFI

gestuurd worden door een verscheidenheid aan onderliggende motivationele processen, zowel autonome als gecontroleerde (die gepaard gaan met externe druk of beloning). Maar ons onderzoek toon ook aan dat specifieke karakteristieken van het SFI kunnen bijdragen aan de creatie van autonome motivatie door tegemoet te komen aan de psychologische basisnoden autonomie, competentie en verbondenheid.

Ten tweede, in Hoofdstuk 5, gebruiken we de theorie van *Communities of Practice* (CoP) en het kader voor waardencreatie (VCF) ontwikkeld door Wenger et al. (2011) om te onderzoeken hoe landbouwers hun deelname in verschillende types SFI activiteiten waarderen. Het onderzoek in dit hoofdstuk neemt dus de sociale interacties waarin de landbouwers betrokken zijn in het SFI als ingangspunt. De casussen waarop we dit onderzoek toepasten zijn de regionale netwerken van Vlaanderen en Noord-Ierland uit het DAIRYMAN-project, een afgelopen SFI dat verspreid was over 10 regio's in Noordwest Europa. Onze resultaten tonen dat verschillende types activiteiten op een verschillende manier bijdragen aan de gepercipieerde waardencreatie van landbouwers. Meer specifiek, vonden we twee complementaire types van activiteiten voor kenniscreatie: activiteiten gebaseerd op interacties tussen landbouwers in groep en adviseurs voor de creatie van meer algemene kennis over duurzame ontwikkeling, en activiteiten gebaseerd op de interacties tussen individuele landbouwers, onderzoekers en adviseurs voor de creatie van meer bedrijfsspecifieke kennis.

Ten derde, in Hoofdstuk 6, gebruiken we Cultural-Historical Activity Theory (CHAT) om de ontwikkeling van een initiatief tot een gevestigd SFI te begrijpen. Door dit perspectief te gebruiken nemen we een systeemperspectief op SFIs als ingangspunt voor onderzoek. We vergeleken de ontwikkelingsgeschiedenis van een gevestigd SFI, Veldleeuwerik (Nederland), en een afgelopen SFI, Beloftevol Boeren (Vlaanderen), om de verschillen in succes om zich tot een gevestigd SFI te ontwikkelen te begrijpen. Onderzoek wijst of het belang van de ontstaansgeschiedenis en de context situatie voor de ontwikkeling van SFIs, omdat ze mee de potentiële richting voor verdere ontwikkeling van het SFI bepalen. Verder vonden we ook dat contradicties die optreden in het SFI kunnen fungeren als drijvende kracht voor ontwikkeling, maar ook kunnen resulteren in een verlaagde activiteit en ontwikkeling wanneer de actoren in het SFI er niet in slagen om de contradicties aan te pakken. Daarnaast wijst ons onderzoek ook op de relevantie van het leerproces of het niveau van het SFI voor de ondersteuning van het leerproces over duurzame ontwikkeling op hun bedrijf van landbouwers. Onze resultaten geven immers aan dat de interpretatie en begripsvorming over duurzame ontwikkeling op niveau van het SFI onvermijdelijk doordringen in het leren en de begripsvorming van de individuele landbouwers die deelnemen in het SFI

Na dit empirisch onderzoek uitgevoerd in hoofdstukken 4 tot 6, reflecteren we op zowel onze resultaten als onze onderzoeksaanpak in Hoofdstuk 7. Hoofdstuk 7 omvat dus twee belangrijke delen. In het eerste deel van Hoofdstuk 7 trachten we onze derde onderzoeksvraag te beantwoorden: *Wat zijn de belangrijke dynamieken en karakteristieken voor SFI ontwerp die op een succesvolle manier leren voor een duurzame ontwikkeling van het landbouwbedrijf kunnen faciliteren?* Hiervoor articuleerden we onze resultaten uit hoofdstukken 4 tot 6 door gebruik te maken van een praktijkgebaseerde benadering (PBA). Door deze PBA te gebruiken, beschrijven we een SFI als een praktijk, die ontstaat door de interactie tussen vier componenten: geroutineerde activiteiten, menselijk handelingsvermogen, materieel-functionele structuur en socio-culturele structuur. Wanneer we onze derde onderzoeksvraag vertalen naar deze PBA-terminologie, zijn we dus vooral geïnteresseerd in het handelingsvermogen van landbouwers om deel te nemen aan de leeractiviteiten van het SFI, en hoe de andere PBA-componenten kunnen bijdragen tot dit handelingsvermogen. Op basis van deze reflectie concluderen we dat volgende aspecten van belang zijn: de motivationele oriëntatie van de landbouwers om deel te nemen, een context die tegemoet komt aan de psychologische basis noden, de combinatie van zowel groepsactiviteiten en activiteiten gefocust op een individuele landbouwer, de ontwikkelingsgeschiedenis van het SFI en de standpunten, praktijken en verwachtingen van actoren extern aan het initiatief (bv. uit het agro-voedingssysteem).

In het tweede deel van Hoofdstuk 7 reflecteren we de perspectieven en de algemene onderzoeksaanpak van dit onderzoek. Op basis van deze reflectie concluderen we met vier suggesties voor verder onderzoek. Ten eerste stellen we voor om de invloed van de bredere sociale, politieke, culturele en institutionele context op de activiteiten van de SFIs te onderzoeken. Maar ook omgekeerd, stellen we voor om te onderzoeken hoe de uitkomsten van de leerprocessen in het SFI doordringen in de bredere context. Ten tweede stellen we voor om te onderzoeken hoe deelnemers van een SFI precies leren, dit wil zeggen de discursieve processen die het leerproces van landbouwers bepalen. Ten derde stellen we voor om de vereiste houding en competenties van actoren die zich engageren in SFIs te onderzoeken. Ten vierde, stellen we voor om de invloed van deelname in SFIs op de eigenlijke implementatie en adoptie van duurzame landbouw praktijken op het bedrijf te onderzoeken.

In Hoofdstuk 8 vertalen we onze resultaten in praktische aanbevelingen voor het ontwerp van SFIs, specifiek gericht aan actoren die betrokken zijn in het ontwerp en de ontwikkeling van (toekomstige) SFIs. Om landbouwers aan te trekken en hun deelname te stimuleren adviseren we om: (i) stimulansen, zoals beloningen, te gebruiken om landbouwers aan te trekken die niet van nature uit gemotiveerd zijn om deel te nemen aan

het initiatief, en (ii) om een omgeving te creëren die bijdraagt aan de bevrediging van de psychologische basisnoden autonomie, competentie en verbondenheid, bv., door beslissingsmacht te geven aan landbouwers, door kansen te bieden voor kennisuitwisseling over duurzame ontwikkeling, en door frequente interacties met andere mensen te organiseren die de landbouwer belangrijk acht. Om een rijk pallet aan waarde te creëren voor de deelnemende landbouwers adviseren we om complementair groepsactiviteiten en activiteiten voor de individuele landbouwer te voorzien. Verder, raden we aan om deze activiteiten te organiseren op locaties die “live” ervaringen uit eerste hand opleveren, bv. op boerderijen, sites van ketenactoren, experimentele boerderijen en veldproeven. Om de voordelige interactie tussen leren op het niveau van de landbouwers en op het niveau van het initiatief te stimuleren, adviseren we om landbouwers te betrekken in de ontwikkeling en leerprocessen op het niveau van het initiatief, bv. door de organisatie van een bottom-up aanpak en kennisdisseminatie doorheen het initiatief. Wat betreft stakeholder betrokkenheid en vertegenwoordiging in het SFI, adviseren we om: (i) een brede waaier aan stakeholders te betrekken vanaf de start van het initiatief en ook om ze te laten vertegenwoordigen in de bestuursorganen van het initiatief, omdat dit bijdraagt aan het leren en de toekomstige ontwikkelingsmogelijkheden voor het initiatief; (ii) om regelmatig ontmoetingen te organiseren tussen het initiatief en de bredere stakeholder groep zodat de inbedding in en afstemming van het initiatief met het agrovoedingssysteem bevorderd wordt.

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AES	Agri-Environmental Scheme
AIS	Agricultural Innovation System
AKIS	Agricultural Knowledge and Information System
BB	Beloftevol Boeren (one of our cases)
CAP	Common Agricultural Policy
CoP	Community of Practice
DM	DAIRYMAN (one of our cases)
FL	Farmer Learning
LINSA	Learning and innovation network for sustainable agriculture
SDT	Self-Determination Theory
SFI	Sustainable Farming Initiative
VL	Veldleeuwerik (one of our cases)
ZPD	Zone of Proximal Development

CHAPTER 1.
Introduction

"Life it is not just a series of calculations and a sum total of statistics, it's about experience, it's about participation, it is something more complex and more interesting than what is obvious".[1]

(Daniel Libeskind)

"Participation, I think, or one of the best methods of educating." [2]

(Tom Glazer)

1.1 The social phenomenon of sustainable farming initiatives

Diversity in initiatives …

Multiple public and private initiatives attempt to support farmers in the sustainable development of their farming practices (Pretty and Bharucha, 2014; Runhaar *et al.*, 2016). These sustainable farming initiatives (SFI) aim to engage farmers, on a voluntary basis, in a trajectory towards sustainable development of their farm management. SFIs can show considerable variety in many respects (Faure, Desjeux and Gasselin, 2012; Moschitz *et al.*, 2015). For example, they can differ regarding the initiators and the other actors involved, as they might be farmers, advisors, representatives of government, researchers, food industry, etc. (Moschitz *et al.*, 2015; Westerink, Melman and Schrijver, 2015). Further, the specific objective of an SFI can be focussed on one aspect of sustainability, such as nutrient management, or can include multiple dimensions (ecological, social and economic) of sustainability. Also, SFIs can differ in the instruments or tools they use to support farmers in their trajectory, e.g., on-farm sustainability assessment tools or farmer group learning.

This diversity is also reflected in the way literature refers to SFIs, e.g., learning and innovation networks for sustainable agriculture (LINSA) (e.g., Moschitz *et al*., 2015), farmer field schools (e.g. Vaarst *et al*., 2007), environmental cooperatives (e.g. Hermans *et al*., 2016), communities and networks of practice (e.g. Oreszczyn *et al*., 2010), knowledge networks (e.g. Sumane *et al*., 2017), agricultural innovation platforms (e.g. Van Paassen *et*

[1] Daniel Libeskind Quotes. (n.d.). BrainyQuote.com. Retrieved January 25, 2018, from BrainyQuote.com Website https://www.brainyquote.com/quotes/daniel_libeskind_341007
[2] Tom Glazer Quotes. (n.d.). BrainyQuote.com. Retrieved January 25, 2018, from BrainyQuote.com Website: https://www.brainyquote.com/quotes/tom_glazer_252884

al., 2014), agri-environmental schemes (AES; e.g. Pavlis *et al*., 2016), or sustainability assessment tools (e.g. Triste *et al*., 2014). A major difference between these initiatives is reflected in the inherent presence or absence of social interaction. Some initiatives include social (group) interaction as an instrument to support farmers in on-farm sustainable development (e.g. all initiatives referring to networks, communities or platforms), while other initiatives rely on one-to-one relationships or individual processes (e.g. agri-environmental schemes or sustainability assessment tools).

In this manuscript, we will not address this full range of SFIs but focus on those initiatives that aim to support farmers in the sustainable development of their farm, by engaging them on voluntary basis, and by creating a social learning environment. In sections 1.2 and 1.3, we will rationalise our interest in these SFIs that provide a social learning environment for farmers in the context of sustainable development.

… and diversity in success

An important observation regarding these SFIs, is that they also show a big diversity in their success to support farmers in the sustainable development of their farm management. Success might be differently defined depending on who's viewpoint is taken into account. At the level of the organizer, success might be defined by his agenda, e.g. according to the number of participating farmers, the persistence of farmer participation, its longevity, its influence on policy, its value for research or its recognition in society. At the level of the participating farmer, success might be defined according to the value their participation yields for them in terms of societal recognition, product prices, knowledge or farm management. For the SFIs we observed in Flanders, we recognized some general constraints in the development of SFIs that seem to hinder their ability to successfully support farmers in the sustainable development of their farms. These demonstrate the difficulty in attracting farmers (e.g., Wilson and Hart, 2000), the limited value farmers perceive or attribute to participating in the SFI (e.g., Smithers and Furman 2003), the difficulty of SFIs to gain recognition from other actors in the AKIS and to become an enduring SFI (e.g., Bui *et al*., 2016; Hermans, Roep and Klerkx, 2016), and the comment that they are insufficiently contributing to sustainable development (e.g., Bui *et al.*, 2016). Based on these observations and in the context of this research, we postulate that four conditions play a role in the SFIs' ability to successfully support farmers in the sustainable development of their farms. First, farmers should participate, because without farmers participating in the initiative, no support can be offered to them. Second, their participation should generate value for them. Third, the SFI should be established, i.e. being durable and recognised for being an SFI. Fourth, SFIs should contribute to on-farm sustainable

development. So failure in successful support might be attributed to a failed ability to attract farmers to participate or to the durability of the SFI. However, due to the above- described diversity in these SFIs, it is difficult to outline design characteristics that contribute to the successful support of on –farm sustainable development.

However, besides merely the diversity of SFIs, also other aspects contribute to the complexity of SFIs, for example, those related to learning and participation in SFIs, as will be explained further in this Chapter. This complexity further complicates the definition of design characteristics for SFI's that are able to successfully support farmers in on-farm sustainable development. To understand the complexity, we first explain the context in which these SFIs emerged. This will be described in the next section. After this, we problematize learning and participation in SFIs, to finally come to our research objective and questions.

1.2 Context: The emergence of SFIs

Sustainable development as a complex concept

On-farm sustainable development has been proposed as a way to deal with the adverse effects of current agricultural intensification and global food production model, such as its negative impact on the environment, human health and the farmers' economic stability (Tittonell, 2014; Petersen and Snapp, 2015; Teschner *et al.*, 2017). However, sustainable development seems to be a contestable concept that is open to multiple interpretations (Loeber *et al.*, 2007). Considering the characteristics mentioned by Rittel and Webber (1973), sustainable development can be described as a 'wicked problem' (Dentoni, Hospes and Ross, 2012), because: (1) there is no agreement on the problem definition because of multiple views and understandings of the problem; (2) it has uncertain outcomes and no clear end point (Rittel and Webber, 1973; Conklin, 2006; Australian Public Service Commission, 2007; Dentoni, Hospes and Ross, 2012); (3) it has many interdependencies and causes and is socially complex; (4) solutions are neither true nor false, but are rather the result of a particular way of articulating the problem. So, not only how the concept of sustainability should be defined, but also how it can be operationalized, for example in agricultural models, is under discussion (Pretty, 1995). Thus, on-farm sustainable development does not prescribe a specific trajectory or techniques to be followed by farmers, as it is always normative and context specific (Pretty and Bharucha, 2014). These discussions make it highly difficult for farmers to understand what sustainable development can mean on their farm and how they can integrate it in their farm management. This particular situation paralyses many of the farmers to take action. By offering levers, SFIs

engage farmers in a learning-by-doing process to operationalize sustainable development in their specific (farming) contexts (Lang *et al.*, 2012).

Box 1-1. Sustainable farming, on-farm sustainable development and sustainable development in agriculture.

To increase the comprehensibility when reading this manuscript, we first define some concepts that will be used in the context of this PhD. The definitions given here only have the function to make these concepts more tangible when reading this manuscript. However, these concepts will always stay contestable (see 1.2) and can be differently interpreted in each SFI case we analyse.

Sustainable farming in this manuscript refers to the farming activity on the farm that allows "*farmers to continue harvesting crop and animal products without degrading the environment or the resource base while maintaining economic profitability and social stability*" (Struik and Kuyper, 2017, p.4). We thus subscribe an approach of sustainable farming that includes three dimensions, i.e., an ecological, social and economic dimension. We will not go further into detail on how these dimensions relate to each other, e.g., according to a bulls-eye model or three pillar model. Sustainable farming practices in this manuscript are defined as the applied practices to ecological, social, or economic problems on the farm that contribute to sustainable farming.

Sustainable development of the farm or **on-farm sustainable development** in this manuscript refers to the process to achieve sustainable farming, i.e. the change in understanding and farming practices that result in a more sustainable farm. Similar to the interchangeable use of sustainable development and sustainability in literature (Struik and Kuyper, 2017), in this manuscript sustainable farming and on-farm sustainable development can be used interchangeably.

As many aspects of sustainability are currently unknown, sustainable farming and sustainable development of the farm should be interpreted as moving targets (Struik and Kuyper, 2017).

Sustainable development and sustainability in agriculture in this manuscript refers to the process and its outcome to provide "enough food and ecosystem services for present and future generations in an era of climate change, increasing costs of energy, social unrest, financial instability and increasing environmental degradation."(Koohafkan *et al*., 2012)

Approaches for achieving sustainable development on farms

In general, different approaches can be applied to encourage farmers to sustainably develop their farms. An interesting categorisation of approaches differentiates between

"budging", "nudging" and mixed incentives (Barnes *et al*., 2013). Budging initiatives refer to incentives that typify a non-choice architecture thus restricting or eliminating choices for farmers (e.g. ban application of fertilizers on land during a certain time of the year or ban application of chemical fertilizer). Nudging incentives refer to incentives that are based on a choice architecture, which are non-regulatory and non-fiscal interventions that could lead to more sustainable farming practices (Barnes *et al*., 2013).

Another distinction is made by de Snoo *et al*. (2013), based on four types of incentives to change behaviour. The first are economic and market based incentives. For example, consumers buying food marked with a sustainability label (e.g. organic products), food processors and retail offering higher payments for sustainably produced food, or food processors and retail requesting specifications regarding the sustainable production of products (e.g. sustainability standards; Luhmann *et al*., 2016). The second type of incentives are economic and based on public contract. Those include, for example, AES and conservation programs, in which farmers enter into a contract to change their behaviour for a number of years, for which they receive an annual payment in return. The third are legal incentives in which farmers are obliged or prohibited to perform a specific behaviour. The fourth are incentives that affect the social moral, and change the social group norms. According to de Snoo *et al*. (2013), the first three types of incentives have a rather short term effect on the farmers' behaviour, or only last as long as the incentive is active, i.e. as long as it is demanded from consumers or processors, until the contract stops, or until legislation changes. They argue that those incentives do not require deep personal involvement of the farmers, nor changes in farm management strategies, or even learning about sustainable farming practices. Long term changes, they argue, are only to take place when new social norms become embedded within the peer group of farmers and the "good farmer" identity of this group.

Authors therefore suggest to support long term behavioural changes by influencing social networks within the farmer community (de Snoo *et al*., 2013; Mills *et al*., 2016). Mills *et al*. (2016), based on Barnes *et al*. (2013), state that new sets of normative standards for accepted behaviour can be obtained through sharing of information and raising the visibility of individual farmer practices among their peers. Following the same stance, de Snoo *et al*. (2013) therefore propose to create instruments that allow farmers to become aware of their own performances compared to their neighbours, and encourage them to exchange experiences and learn from each other. Further, while referring to AES, Saxby *et al*. (2017) argue that incentives often are too generally designed and implemented, without taking into account specificities of the farm, such as its size, type or location. They therefore state that "*it is essential [that] the responsibility for developing management solutions remain with the*

farmers even though the environmental objectives of the schemes themselves are specified by the government" (Burton and Paragahawewa 2011). Mills *et al*. (2016) call for a balanced mix of approaches involving partnership working with individual farmers or farmer groups, financial incentives and regulations, in which regulations and incentives are elements to signal societal norms and expectations. The partnership working is then a way to include the farmers' responsibility for developing management solutions, enabling them to experiment with different options and to contribute their own knowledge (Mills *et al*., 2016). This requires farmer involvement in the development of and the decision making on more sustainable farming practices.

Systemic perspective on knowledge creation and extension

Further, the complexity of sustainable development challenges the predominant linear view of knowledge transfer in farm advice as a top-down process, in which farmers are seen as mere consumers/adopters of knowledge generated by agricultural research and transferred by advisory and extension services towards practice (Moschitz *et al.*, 2015). Such a linear approach does not address the heterogeneity in production contexts, farming styles and the complexity of natural resource management (Klerkx, van Mierlo and Leeuwis, 2012). These insights shifted the perspectives on agricultural advice towards systems approaches in which agricultural producers, as other agri-food and institutional actors, are seen as important actors in the knowledge creation process (Klerkx, van Mierlo and Leeuwis, 2012; Moschitz *et al.*, 2015). Such a constructivist view on knowledge is reflected in the introduction of systemic models thinking in the domain of agricultural extension (Blackmore, 2010), e.g., the agricultural knowledge and information/innovation system[3] (AKIS; Klerkx *et al*., 2012) and Learning and Innovation Networks for Sustainable Agriculture (LINSA; Brunori *et al*., 2013). This shift in perspectives requires multi-actor approaches in which interactivity, engagement and collaboration are central, which blurs the strict categorization of knowledge 'producer' and 'user' (Klerkx, van Mierlo and Leeuwis, 2012). Hence , this entails learning on new ways of organizing farm advice, on new roles and required competencies of the actors involved.

Re-orientation of research

The complexity of the concept of sustainable development and the systemic perspective on knowledge creation also challenges agricultural researchers interested in sustainable development. They have to learn to deal with the context specificity of sustainability and its developmental nature, and have to accustom themselves with participatory and multi-actor

[3] For an overview of the emergence of the AKIS and AIS concept see Klerkx et al. (2012)

(research) approaches. Scholars increasingly acknowledge the need for a "*changing role of researchers from being a source of knowledge to engaging in knowledge exchange processes"* as they are just one of the many contributors to and deciding factors of systemic change and innovation (Moschitz *et al.*, 2015). However, the main paradigm in research still seems to support the linear approach between research and society. The adoption of these new roles requires a learning process, which we also experienced in our own research group. Similar to other regions, Flemish researchers were confronted with the complexity involved with sustainable development and the required experience for performing participatory research. The aim to define sustainability for Flemish agriculture resulted in the development of a tool aimed to assess on-farm sustainability (Meul, Passel and Nevens, 2008). However, this tool never succeeded in becoming an established tool in Flemish agriculture. This experience and the evaluation of the development process of the sustainability assessment tool revealed that many issues matter when one wants to support on-farm sustainable development; e.g. that a more systemic perspective rather than solely providing a sustainability assessment tool is needed to support on-farm sustainable development and that (social) learning is key. This in-depth evaluation sets the scene for current dissertation and is outlined in Chapter 3.

1.3 Participation and learning in SFIs

Based on the above analysis of the challenges, we consider two features as crucial for on-farm sustainable development: learning and participation, which we will discourse in-depth in the following paragraphs. First, the above shows that learning is required on multiple regards, i.e., learning on sustainable development of the farm in a given context and learning on how to organize the support for the learning on sustainable development. Further in this section, we will elaborate on both learning perspectives and explain how they are related. Second, by referring to processes of interaction, engagement and collaboration, the above also stresses the importance of the social in learning in the context of sustainable development. This requires participation from multiple actors in these social learning processes.

Indeed, as argued in literature, the wicked concept of sustainability calls for learning as an essential element of initiatives that seek to contribute to sustainable development (Loeber *et al.*, 2007). Loeber *et al*. (2007) consider learning as a way to ensure that any particular elaboration of what is sustainable, is meaningful and practical to whom it concerns. It facilitates the determination of sustainability in a given context, induces processes of value judgment and supports system innovation through reflection on theories, beliefs and assumptions underlying action (Loeber *et al.*, 2007). Further, Pretty (1995)

argues that "*participation is an essential component of any system of learning, as no change can be affected without the full involvement of all stakeholders and the adequate representation of their views and perspectives".*

However, based on negative experiences of practitioners, concern grows on whether stakeholder participation indeed succeeds in living up to the many claims that have been made on its use. Reed (2008) gives some examples of experienced difficulties related to stakeholder participation, for example, the occurrence of unexpected or negative interactions within existing power structures between stakeholder groups, consultation fatigue amongst stakeholders when they perceive there involvement gains little reward or influential capacity, the participation processes become "talking shops" and delay decisive action, some positions are not negotiable and limit the empowerment of participants to influence decisions. Based on his research, Reed (2008) states that the outcomes of stakeholder participation are strongly dependent on the nature of the process leading to them and suggests to shift focus from the tools of participation, to participation as a process. But, to better understand the factors that make stakeholder participation to lead to more durable decisions, it should be studied in different contexts (Reed, 2008). In the context of this manuscript, SFIs that support on-farm sustainable development by creating a social learning environment is such a context.

Educational literature already paid a lot of attention to the kind of education that enhances learning, and how participation is required in the context of sustainable development. We will refer to this literature in the following sections.

Perspectives in Education for Sustainable Development (ESD) [4]

The United Nations defines education for sustainable development (ESD) as a practice that: "develops and strengthens the capacity of individuals, groups, communities, organizations and countries to make judgments and choices in favour of sustainable development." (Van Poeck and Loones, 2011). Thus, education should be interpreted broader than the formal education offered in schools and universities. We follow Biesta (2009) who defines education as a "specific setting in which learning takes place (…) with a specific set of relationships, roles and responsibilities". UNESCO (2012) recognizes the emergence of non-formal education, often initiated by the commercial/private sector, community groups, civil society organizations, non-governmental organizations (NGO's) and networks seeking to engage citizens in sustainability issues. These non-formal contexts for ESD go along with forms of learning and education, which define participation in local development, use of

[4] Based on Triste *et al*., 2014

local knowledge and recognition of local realities as crucial. We equally consider the emergence of SFIs in this development.

Wals (2010) recognizes two perspectives on ESD: an instrumental perspective and an emancipatory perspective. This division is similar to what Vare and Scott (2007) determined as ESD1 and ESD2. According to Van Poeck and Vandenabeele the instrumental perspective or ESD1 is still the dominant discourse (Van Poeck and Vandenabeele, 2012). This type of education facilitates changes in what we do by promoting predetermined behaviours and ways of thinking (Vare and Scott, 2007). It relies on a strong sense of what is right and should be done, and on a high certainty about the current knowledge and the kind of behaviour needed (Vare and Scott, 2007). Therefore, this perspective is mostly expert driven and understands learning as a way to achieve sustainability in a very particular way (i.e. learning 'for' sustainability). In initiatives for sustainable agriculture, this instrumental perspective on ESD is for example integrated in most of the agri-environmental schemes (AES), in which farmers are rewarded to adopt specific environmental management behaviours on their farms (de Snoo *et al.*, 2013).

However, the instrumental perspective does not fit the idea of sustainability as a wicked problem. People's behaviour is too complex and contextual to be captured in a straightforward model based on a linear relationship between knowledge, awareness and behaviour (Wals, 2010). Moreover, the complex concept of sustainability, its susceptibility to multiple perspectives and the uncertain knowledge linked to it, asks for a different approach. Instead, people need to develop capacities and qualities allowing them to contribute to alternative behaviours both individually and collectively (Wals, 2010). This viewpoint is also reflected in the emancipatory perspective or ESD 2. It recalls the foundation of education which is about encouraging autonomous thinking (Wals, 2010; see also Jickling, 1992), and therefore education should be driven by a collaborative and reflective learning process (Vare and Scott, 2007). It interprets sustainable development as an ongoing learning process, and aims for empowering, building capacity to think critically, and involving and engaging learners in issues that affect them and others.

Whereas some claim that the instrumental perspective on ESD cannot match with the complexities and uncertain knowledge related to sustainability, Vare and Scott (2007) advocate for a complementary use of the instrumental and emancipatory perspectives. This call for combined use of and instrumental and emancipatory perspective has implications for educators. They have to: (i) use strategies that clearly promote learning as an outcome as well as means to an end, (ii) use different learning strategies, such as information and communication balanced with facilitation of learning through mediation, (iii) be open towards unplanned directions learners will take, (iv) evaluate by asking questions as "what has been

learned?" instead of "has it been learned?" (Vare and Scott, 2007). This combined use of perspectives in practice particularly emerges in education in non-formal contexts.

These educational practices have following common characteristics (Wals, 2010), that according to us equally apply to SFIs:

- learning is more than knowledge-based,
- they focus on 'real' issues for engaging learners,
- they view learning as transdisciplinary and trans perspectival,
- it cannot exactly be known what will be learnt and learning goals might shift during the learning process (i.e. 'indeterminacy of the learning process').

What should be learned

The above description of ESD suggests that what is learned can differ significantly, and that in literature one can find different perspectives on education, each using particular concepts in relation to the learning process involved. Many theorists have tried to exemplify the different types of learning outcomes. For example, Mezirow (1997) distinguishes instrumental, communicative and transformational learning. Instrumental learning refers to acquiring knowledge and skills for task oriented problem solving (Reed *et al.*, 2010; Lankester, 2013), communicative learning refers to understanding and reinterpreting knowledge through interaction with others (Reed *et al.*, 2010), and transformative learning refers to changes in the frame of reference, attitudes, behaviour and social norms (Reed *et al.*, 2010; Lankester, 2013). Other concepts, often used in the context of change, are the loops of learning conceptualized by Argyris and Schön (1978, in: Reed *et al*., 2010; Evely *et al*., 2011; Löf, 2010), in which single, double and triple loop learning is distinguished. Single loop learning entails learning about the consequence of specific actions, double loop learning entails changes in the assumptions which underlie our actions, and triple loop learning challenges the values and norms that underpin our assumptions and our actions (Reed *et al.*, 2010; Evely *et al.*, 2011).

As argued above in the section on ESD, for sustainable development, we must go beyond the basic single loop learning, and aim for the deeper second and triple loop learning (Sterling, 2007). This deeper learning has greater impact on how individuals understand a problem and behave (Evely *et al.*, 2011). However, as van Mierlo *et al*. (2010) describe, people are rather inclined to learn at single loop level, in which basic assumptions are left unchanged. What is learned and the extent to which is learned depends on multiple factors (Evely *et al.*, 2011). In literature, social learning processes have been recognized as "*a key mechanism for sustainable development* (Pyburn, 2007)". However, the level of participation is also likely to influence what is learned (Pretty, 1995; Evely *et al.*, 2011). On

this regard, Pretty (1995) distinguished seven types of participation of people in development programs and projects: ranging from passive participation, in which participation is limited to being told what has to happen and act through predetermined roles, to self-mobilization, in which people take initiatives independent from external institutions.

Who should learn and how

Following the perspective on learning as being a participatory and thus a social process does not necessarily define who learns. Indeed, different interpretations exist of what social learning actually is (de Laat and Simons, 2002; Reed *et al.*, 2010), ranging from ideas that explain what and how social interactions contribute to individual learning to those that focus on collective learning or those that include both (Blackmore, 2007). de Laat and Simons (2002) offer a clear categorization of learning theories by distinguishing the type of learning process and the type of learning outcome: (i) individual learning processes with individual outcomes; (ii) individual processes with collective outcomes, (iii) learning in social interaction (the learning process is collective, but the outcome is individual), (iv) collective learning (both learning processes and outcomes are collective).

In the context of sustainable agriculture, multiple researchers used the concept of social learning, and defined it as “simultaneously transforming the cognitive, social and emotional competences, including attitudes and values related to collective or individual social actors“ (Moschitz *et al*., 2015). As a result, new meanings are co-created, practices are developed and identities are rebuild (Moschitz *et al*., 2015). Beers *et al*. (2016) complement that these processes integrate knowledge from multiple perspectives, represented by a heterogeneous set of actors, and produce new knowledge that serves as a basis for joint action (Pahl- Wostl, 2006; Beers *et al*., 2016). This definition refers to the occurrence of deeper learning (transforming competences, attitude and values), both at individual and collective level in social interaction. We contend that both processes are required in SFIs too.

In this way, the concept of collaborative learning, used by educational scientists to depict learning together in groups with equal status (Beers *et al*., 2016), might better comprehend the learning process we are interested in. Collaborative learning entails both learning through social interaction and *“collective learning whereby the group as a whole strives towards the shared aim* (Kuusisaari, 2014)*”*. ‘According to Oxford (1997, p.p.443-444), “*collaborative learning has a “social constructivist” philosophical base, which views*

learning as construction of knowledge within a social context and which therefore encourages acculturation[5] *of individuals into a learning community*".

The above descriptions of social and collaborative learning might insinuate that these are easy and seamless processes, occurring without obstacles of frictions (Dyball *et al*., 2007; Leeuwis, 2000). However, in the words of Crehan and von Oppen (1988; in: Leeuwis, 2000), these processes should rather be seen as "*an arena of struggle between different groups with different interests".* Indeed, each participant in the social learning process has its own identity, interests, aspirations and opinions, which might result in social conflict, frictions or struggle (Dyball *et al*., 2007; Wildemeersch, 2007; Leeuwis, 2000). Therefore, several authors state that social learning processes should be related to processes of negotiation (Dyball *et al*., 2007; Wildemeersch, 2007; Leeuwis, 2000), which can result in either diverging or converging mental models (Scholz *et al*., 2011). Dyball *et al*. (2007) propose a constructive approach to negotiation, that assumes that conflict generates opportunities for learning. According to this proposition, competing opinions and evidence should be welcomed because they create conditions for generating new knowledge. However, according to Hermans (2011) and Wildemeersch (2007), a balance between convergence and divergence of mental models should be sought (or consensus and dissent in the words of Wildemeersch (2007)). As Hermans (2011) states, too much consensus might narrow the groups' vision by discarding all contradictory or inconvenient information. On the contrary, too many competing or contradictory mental models can inhibit action. This thus requires facilitation which creates a creative tension between consensus and dissent (Wildemeersch, 2007).

Learning and participation in SFIs

To sum up, as learning for sustainability requests social learning processes that go beyond first order learning, we are interested in those SFIs that provide a social learning environment for its participants in which new meanings and knowledge are co-created to form a basis for action. Furthermore, participation has been defined as a key attribute in social learning processes (Pyburn, 2007) and a main concern is thus how to facilitate active engagement and participation of farmers. Both attributes, participation and facilitation, reflect two important entry points in our research. Participation reflects the entry point of the individual actors (including farmers) engaging in a social learning process, and as described different degrees of participation can result in different learning outcomes. Facilitation reflects the entry point of the SFI as an organization providing a context in which the learning

[5] "Acculturation means letting go of elements from one's own culture and adopting elements from the host culture." (Vloeberghs *et al.*, 2011, p. 20)

process takes place. Further, as mentioned earlier, we argue that in SFIs learning should take place on two accounts: learning on sustainable development on the farm on the one hand and learning on how to organize this learning on sustainable development on the other hand. Farmers, and other relevant stakeholders, have an important role to play in both learning processes. Moreover, we argue that these actors play a double role in these processes, thus creating a dynamic interaction between both processes. First, by participating in an SFI, farmers (as other actors) learn about sustainable development within the context of the SFI. What and how they learn on this account is influenced by, for example, the tools used, the meanings given to sustainability, or the actors involved in the SFI. Otherwise, by participating in the SFI, making contributions to the common pool of knowledge and experiences within the SFI and by adjusting their (farming) practices, they also contribute to the learning process of the SFI at organizational level itself. So to understand the design characteristics for SFIs that are successful in supporting on-farm sustainable development, it is the challenge to understand and unravel both processes as well as the dynamic interactions between them. So, we need a research approach that allows us to grasp these interactions.

1.4 Challenges, research objectives and research questions

In this dissertation, we are interested in how SFIs can successfully support farmers in on-farm sustainable development. Based on the previously described relation between participation and learning, we focus our research on SFIs in which farmer participation goes further than the mere adoption of directed sustainable farming measures and we defined specific challenges related to these SFIs. First, the lack of a fixed blueprint for SFI design and the considerable variation in success between existing SFIs, cause a challenge for SFI initiators and organizers to design an SFI that successfully supports on-farm sustainable development by engaging farmers to participate. A second challenge is related to the observation that learning in SFIs is required on different, but interrelated, accounts. Learning is required both on how to sustainably develop a farm in a given context and on the development of a successful SFI in this given context. Third, SFIs require learning of all participating actors, including farmers, SFI initiators and organizers, and researchers. To be clear, in this research we will strictly focus on the dynamics within SFIs, and not on how the SFIs contribute to sustainable development in agriculture. This would lead us away from our current interest in farmer participation and learning support in SFIs.

Based on these challenges, our research objective is **to reveal key characteristics of SFI design by investigating the dynamical interrelations that can facilitate the learning of farmers within an SFI.**

To accomplish this objective, we explored three main research questions based on the described scientific and societal challenges.

RQ 1. How can we understand and investigate the dynamical interactions between the learning of participating farmers and the learning of the SFI?

This research question focusses on how we can conceptualize and link the different accounts of learning in SFIs. Unravelling this question will strongly define our research approach and general framework. Both will be addressed in Chapter 2. This framework will then be used to discuss and conclude on the main findings in Chapter 7 and 8. However, the more specific methods used to answer the following research questions will be clarified in the relevant chapters.

RQ 2. What are relevant dynamical interactions at play between participating farmers and the SFI?

Based on how we defined a successful SFI: i.e. being able to attract farmers, being of value for farmers, and being established, we formulated three sub-questions related to participation in SFIs.

RQ 2.1. What is the motivation of participating farmers to participate in voluntary SFIs, and how is this motivation influenced by the participation context created by the SFI?

RQ 2.2. How do different design characteristics contribute to perceived value creation for farmers participating in an SFI?

RQ 2.3. Which organizational dynamics contribute to the development of an established SFI?

These sub-questions will be addressed, respectively in Chapter 4, 5 and 6. The insights gained from addressing these three specific research questions should then contribute to our overall research question, addressed in Chapter 7 and 8:

RQ3. What are key dynamics and characteristics for SFI design that successfully facilitate farmers' learning for on-farm sustainable development?

CHAPTER 2.
Research approach

Based on the research context and challenges described in Chapter 1, we constitute a conceptual framework that allows us to answer our research questions. First, we stipulate three levels that can aid us to understand the dynamics at play in SFIs. Second, we search for perspectives and frameworks that can help us to answer our specific research questions 2.1 -2.3. Third, we search for a research perspective that takes into account the complexity related to participatory processes and learning, and enables us to articulate our findings from the specific research questions to conclude on the overall research question 3. After this, we explain how we selected the cases for our empirical research. Finally, we conclude with the structure of the following chapters.

2.1 Nested levels to unravel dynamics in SFIs.

Our search to unravel the dynamics within SFIs started by the identification of three nested levels that we can relate to participation and social learning based on our description in Chapter 1 (section 1.3 – Learning and participation in SFIs): the individual (farmer) level, the organisational level of the SFI, and the context level.

In this research, the level of the individual will mainly focus on the individual farmers, and not advisors, researchers, chain actors, or other actors that might be involved in the SFIs, because farmers are the SFIs' focus for support in on-farm sustainable development. The level of the SFI represents the learning and participation context for farmers created by the SFI. It is the level where governance is of high importance. Referring to Roep and Wiskerke (2007, p. 208) and Berger (2003), we define governance as all aspects related to creating, maintaining and governing the SFI. It thus includes both the governance structure (i.e. the way an SFI is organized and the actors involved) as well as the governance processes. As mentioned in section 1.4, we distinguish two important types of activities or governance processes at this level: activities involving support for farmer learning and activities involving the development of the SFI. Such activities encompass, for example, division of roles, decision making procedures, power relationships within the SFI, contractual arrangements, codes of practice or style of governance (e.g. top-down or bottom-up decision making, negotiation, consensus building, ...). Finally, the context level represents the broader social, cultural and environmental context in which the SFI and individuals act.

As mentioned in Chapter 1, we expect important dynamical interactions related to participation and social learning between these three levels that are of relevance for the development of a successful SFI. We expect interactions between the individual and SFI level regarding both the farmers' motivation to participate in an SFI, which takes the individual as an entry point (as reflected in RQ 2.1) and regarding the value created for the farmers participating in the SFI (as reflected in RQ 2.2). Further, we also expect interaction between the individual farmers, through farmer participation (see section 1.3) and the development of the SFI. Further, we expect mutual interaction between the SFI and the context level. We expect that the development of an established SFI is influenced by context level, e.g., through discourses in society or developments in the AKIS, and that the SFI can influence the context level by contributing to outcomes on societal level (e.g., changed perspectives, widespread accepted best practices, changed legislation, or diminishing environmental pressure). Throughout this thesis, we want to focus on the dynamical interactions between these levels. This influenced our choice of theories to answer our specific research questions as explained in next section 2.2.

2.2 Three perspectives to answer our specific research questions

In section 1.4, we proposed three specific research questions to investigate the dynamics at play within an SFI. As explained in section 2.1, we reason that these dynamics are constituted by the interplay between different levels related to participation and learning in SFIs. To address these complex dynamics and to enable us to build a rich picture of SFIs, we needed, and thus, searched for different perspectives that take into account the interplay between the individual, SFI and context level. The first perspective is a rather individual perspective compared to the other perspectives, and focusses on farmers' motivation as an entry point, the second perspective is more integrated takes the social interactions related to farmer participation as an entry point, while the third perspective is even more integrative, and uses a systemic approach on SFIs as entry point. In following paragraphs, we will elaborate on the three perspectives and why we have chosen them in this research. How exactly these perspectives are operationalized in our empirical research, will be described further in the Chapters 4 to 6.

A first, rather individual perspective is reflected in our choice for the Self-determination theory (SDT; Ryan and Deci, 2000b), a frequently used theory on motivation in psychological research in multiple domains. This theory is used to answer our first specific research question, i.e., to understand why farmers participate in voluntary SFIs and how this motivation can be influenced by the participation context created by the SFI (see Chapter 4). The theory caught our interest specifically because of following reasons. First,

SDT is an organismic theory, which means that it concerns people's inherent growth tendencies and innate psychological needs. In SDT, people are seen as innately curious and interested, who "*possess a natural love of learning and desire to internalize knowledge, customs and values that surround them*" (Niemiec and Ryan, 2009). This perspective seems relevant and interesting in the context of social learning processes that aim at the negotiation and internalization of new meanings on on-farm sustainable development. Second, it is a theory that focuses on the quality of an individual's motivation in a given context, by conceptualizing different types of motivation. Moreover, the theory has shown that the quality of the motivation can be linked to the behavioural engagement, which in our case is participation and engagement in activities of the SFI (Hagger and Chatzisarantis, 2009). The theory thus allows to describe the different types of motivation farmers have to participate in an SFI, and make predictions on how these motivation types influence their engagement in the SFI. Third, it argues that the internalization process can be supported or thwarted by contextual factors in the social environment (Deci and Ryan, 2000), that enable satisfaction or frustration in the fulfilment of psychological needs within a given context (Osbaldiston and Sheldon, 2003; Ryan and Deci, 1987; Vansteenkiste *et al*., 2010; Lavergne *et al*., 2010; Hagger and Chatzisarantis, 2009). SDT thus provides a framework to understand why the more qualitative motivation types are present or not with the farmers participating in the SFI. Fourth, there is abundant research and material available on how to perform research and construct questionnaires using SDT. However, SDT provides us information on how to investigate farmers' motivation to participate and how specific SFI characteristics contribute to a qualitative motivational disposition, but it does not allow us to investigate how the social interactions and activities in which the farmer participates in the SFI contributes to learning. Therefore, we address a second perspective.

A second perspective, giving a more prominent role to the social learning aspect in SFIs, was used to answer the second specific research question on value created for farmers during participation. Searching for a framework that enabled us to evaluate participation in SFIs, the Value Creation Framework (VCF; Wenger *et al*., 2011) appeared, as it was developed to evaluate value creation within CoPs (CoPs; Wenger *et al*., 2002) and Networks of Practice (NoPs). More concrete, the VCF was created to provide a foundation to evaluate how communities and networks create value for their members, hosting organizations or sponsors, by using different types of data sources. This framework thus seems promising to evaluate an SFI on how it contributes to value creation for farmers participating in it. The VCF was specifically created to evaluate CoPs and NoPs. CoPs are defined as "*groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an*

ongoing basis" (Wenger *et al*., 2002). The CoP-model developed by Wenger *et al*. (2002) has been valued as a practical approach to operationalize social learning, by relating it to social structures and to the practices of participants in the process (Ingram *et al*., 2014; Morgan, 2011). It allows to make a connection between social and individual learning and to take into account interaction in learning (Beers *et al*., 2016). It emphasizes the situated nature of knowledge and learning, thus giving a central role to participation (Vare, 2008). In this sense, it views learning as a process of participation and participation as learning (Vare, 2008). In this way it fits the advocacy for learning and participation as important features for sustainable development as described in Chapter 1. According to the CoP-model "*knowledge is found in, and built from, shared practice, rather than being transferred in a linear fashion from master to learner"* (Morgan, 2011). Bertone *et al*. (2013) stress the distinction between two views of analytical approaches using the CoP-model. The first view represents a rather 'de facto'-use in which an active group is checked against the list of key attributes of CoPs to evaluate whether it is allowed to be called a CoP (e.g., Morgan, 2011). A second, rather instrumental view does not keep this strict to the scientific CoP-criteria and focusses on highlighting good practices of knowledge management by evaluating knowledge management strategies in active groups that could be identified as CoPs. By using the Value Creation Framework developed to evaluate such CoPs and NoPs to identify design features for value creation for farmers, our research adopts this second more instrumental view on the use of the CoP-model. So rather than contributing to insights in CoP-theory, our aim is to increase our understanding in the design features that contribute to knowledge management and social learning outcomes in SFIs that are valued by farmers.

The two previously mentioned perspectives mainly focus on the relation between the individual farmer and the environment created by the SFI. The SDT-perspective is used to contribute to the understanding of the farmer engagement in the SFI by investigating their motivation to participate in the SFI and also how the individual farmers' motivation to participate can be influenced by characteristics of the SFI. The second perspective, using VCF and CoP, focusses on how the learning processes within an SFI contribute to value creation for the farmers as individual participant in the SFI. Both perspectives thus contribute to our understanding of the governance processes that support farmer learning (see section 2.1), and not reveal how participation in an SFI results in the development or learning at the level of the SFI. If we aim to understand how SFIs learn and develop into an established initiative in course of time, we will need a more systemic perspective that takes into account dynamics of change. Although the CoP perspective takes into account aspects of social learning, it pays less attention to change. As argued by Nicolini (2012), the CoP perspective rather focusses "*on the idea of the reproduction of practice in time through a*

process of active engagement and participation sustained by a specific community". Citing Fox (2000; in: Nicolini, 2012): "*Communities of practice theory tells us nothing about how, in concrete practice, members of a community change their practice or innovate".*

An interesting perspective on this account is the comprehensive model of Cultural-Historical Activity Theory (CHAT) as developed by Engeström (1987). This theory allows to view SFIs as object-oriented activity systems, in which the activity and its agents are motivated to engage in the activity through the transformation of the object into an outcome (Nicolini, 2012). This is inherent to the first principle of CHAT, i.e. it takes collective, artefact-mediated and object-oriented activity systems as unit of analysis (Engeström, 2001). Because the theory is developed also as an interventionist approach, it offers a practical model to capture the analytical elements of an activity system, including their mutual relations. The elements are defined as the subject (the person or group engaged in the activity, who's perspective on the activity is taken into account), the object, the tools, rules, community and division of labour (see Chapter 6 for a more detailed explanation). The way these elements are depicted in the model reflect the system-ness of activity systems and offers an integrated approach to understand human activity (Nicolini, 2012). A second principle of CHAT is the multi-voicedness of activity systems, which stresses that a community always represents a gathering of multiple points of view, traditions and interests (Engeström, 2001). The third principle of CHAT is *historicity*, which recognizes the transformative nature of activity systems over lengthy periods of time (Engeström, 2001). Moreover, they state that a current state of an activity system should always be understood against its own history. A fourth important principle in understanding the dynamics of an activity system is that it gives a central role to contradictions within and between elements of the activity system as sources of change, development and expansion (Engeström, 2001; Nicolini, 2012). A fifth principle of CHAT is that major qualitative changes in the activity system occur through expansive learning. This occurs when the object and the activity system are transformed (Seppänen, 2002), as a result of overcoming the contradictions within the activity system. However, expansive learning cannot be seen as a predetermined course of development, because what will be learned is not yet known from the start. These principles of CHAT highlight the conflictual and developmental nature of an activity system (Nicolini, 2012), which is particularly interesting to understand how SFIs developed into a given state in time.

Based on the above descriptions, we believe that these three perspectives can help us to unravel and understand different types of dynamics at play in SFIs. However, we question how the insights from these perspectives can be articulated into a richer picture on the relevant dynamics and characteristics of SFIs to successfully support and facilitate

farmers' learning for on-farm sustainable development (RQ3). In this pursuit, we found practice theory as a potential perspective, that takes into account the complex dynamics related to participatory processes and learning in SFIs.

2.3 A practice theory perspective to further articulate the dynamics

Because of their diversity and complexity, we found it difficult to describe the social phenomenon of SFIs based on one specific framework in literature. This is also reflected in the different perspectives chosen above to unravel the dynamics in SFIs, which originated in very different theoretical strands. But, we are not only interested in these individual dynamics, but also how these dynamics constitute an SFI as a whole. As reflected in RQ 3, we question how SFIs can be described in terms of relevant dynamics and characteristics to support on-farm sustainable development, with the aim to inform (future) initiators of SFIs. So we searched for an integrative perspective that allows to capture and describe the multiple dynamics as described in Chapter 1, i.e., the learning process that support on-farm sustainable development, the learning at the level of the SFI which is reflected in their developmental nature, the role of the participants in both processes and the interrelation between both processes. A promising strand in sociology that aims to understand social phenomena is practice theory. Multiple practice-based approaches (PBA) to operationalize the theory originated from its basic ideas. In agricultural research, however, the use of PBA's as research lens is seldom been explicitly referred to (e.g. Mengistie *et al*., 2017). By applying such a PBA, we choose to approach an SFI as a practice. In Chapter 7, we use a PBA to further articulate our findings from the different empirical chapters (Chapter 3-6) and we test its value to provide us with richer information on the dynamics in SFIs. In following sections, we first describe the basic principles and concepts of practice theory, then link it to learning, and finally aim to operationalize it for the purpose of this research.

2.3.1 Practice theory

Rather than being one specific theory, practice theory is merely a broad group of theoretical approaches that are connected through their history and similarity of concepts (Reckwitz, 2002; Nicolini, 2012). These theories emerged as a response to the divide between methodological individualism, in which social phenomena are explained as being merely a result of individual actions, versus methodological holism, in which phenomena are explained as being defined by structure or structural elements (Postill, 2010). Practice theorists acknowledge that "*actors are not entirely free to act but at the same time their actions are not completely determined by social structures* (Buchs *et al*., 2011, in: Touliatos

2011). Many theorists have contributed to this stance, each following different routes and developing their own concepts e.g., Bourdieu (1977), Giddens (1984), Ortner (1984), Schatzki (2001), Reckwitz (2002), Warde (2005) (Postill 2010). They have in common, that, to investigate change, they focus on practices (Reckwitz, 2002), "*rather than [investigating] the individuals who perform them or the structures that surrounds them"* (Hargreaves, 2011). Thus they provide insight on the interrelation between actors and social structure (Touliatos, 2011).

The different practice theories each define a practice in their own way. As Nicolini (2012) puts it: "*Naming, defining, and exemplifying practices is already theorizing them*". A rather general description is given by Blackmore *et al*. (2012)*,* who define a practice as "*a generally accepted and shared habitual, taken for granted ways of performing an activity, with its attendant values, understandings, communications and cooperative routines".* Across theories, there seems to be a consent that practices are composed of "*configurations of actions which carry a specific meaning*"; e.g. moving a hand forward can be a component of the practice of 'greeting by shaking hands' (Nicolini, 2012, p. 10). Pointing to the diverse meanings given to practice, Hager (2012) distinguishes between more inclusive and less inclusive accounts of practice as two ends of a continuum along which accounts of practice can be located. The place of an account of practice on this continuum, and thus the way an author deploys the term, also influences the analysis that can be performed by using the term (Hager, 2012). In more inclusive accounts, practice actually encompasses a collection of disparate activities, which themselves may or may not be practices. However, Hager (2012) states that, even in their most inclusive sense, practices need to exhibit certain minimal features. A first typical feature is that practices are intentional, directed to achieving a goal. Another feature is that they need to be rule-governed routines (Hager, 2012). Rules in this sense are often tacit, but refer to the fact that the performer of a practice should act according to various rules that together constitute the practice. In more exclusive accounts of practice, activities have to meet more stringent criteria to be called a practice. In these accounts, practices consist of interdependences between "*bodily activities, forms of mental activities, "things" and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge"* (Reckwitz, 2002). According to Gherardi (2015), what differentiates a practice from an action, is its recursive nature. Practices exist and are sustained over time through the reproduced performance of these configurations of actions (Ortner, 1984). Inspired by Giddens (1990), Gherardi (2015) puts it as follows: "*social practices are not brought into being by social actors but are constantly recreated by the same means whereby they*

express themselves as actor". Thus, "*for a practice to be a practice, it must be seen as such by its practitioners, and must therefore be socially sustained*".

However, the recursive nature of practices, as also reflected in the word 'routines', does not mean that practices are not subjected to change. In practice theories, individuals are depicted as agents, or 'carriers' of practices, who 'carry' and 'carry out' social practices (Reckwitz, 2002; Nicolini, 2012). Moreover, Kemmis *et al*. (2012) state that practices are not visible as a whole in the performance of one individual actor, but rather in the orchestrated performed activities of multiple actors. These practices, recursively carried out, are never performed in an identical way, which relates to "*the idea of change as a continuous process* (Gherardi, 2015)". Practice theories are therefore concerned with "*how social beings, with their diverse motives and their diverse intentions, make and transform the world in which they live* (Ortner, 1984)".

On the other hand, practices are also shaped by the social environment, i.e. circumstances and conditions that are external to them, and make it possible to perform a practice (Kemmis *et al.*, 2012). According to Kemmis *et al*. (2012), the structural circumstances and conditions include both so-called practice architectures, i.e. the sayings, doings and relating that give a practice meaning, but also the so-called ecologies of practices, i.e. the complex or network of practices in which a practice is embedded and is connected to. Moreover, as practices are always situated in time and space, they are already shaped by the particular historically given conditions related to a given space and moment (Kemmis *et al.*, 2012). Thus practice theories can help to understand where a system comes from, how it is produced and reproduced, how it may have changed in the past, and how it may be changed in the future (Ortner, 1984). Their analytical effort "*is not to explain one chunk of the system by referring it to another chunk, but rather to explain the system as an integral whole […] by referring it to practice* (Ortner, 1984)".

2.3.2 Practice theory and learning

Now, how does practice theory relate to learning? Based on six threads in PBA, Reich and Hager (2014) argue that learning is entwined in practice. To understand how they are entwined, the classification of Hager *et al*. (2012) is a useful help. In this classification, learning theories are subdivided in three main groups, each with their own conceptualization of what learning and practice entails. A first group encompasses cognitive-psychology based theories of learning. They focus on the rational and cognitive processing of the individual learner. Learning is treated as a thing that can be acquired or transferred by learners. In this way practice is interpreted as thinking followed by application of this thinking. These theories strongly relate to the linear models of knowledge exchange referred

to in section 1.2. A critique on these theories is that they neglect the role of social, cultural and organizational factors in learning. These factors are addressed in a second group of sociocultural theories of learning. These theories do emphasize these factors together with other contextual aspects of learning. They interpret learning as an ongoing process of participation and reject the idea of learning being a thing. Further, they reject the mind-body dualism, by recognizing the importance of the embodied nature of learning and practice performance. A third group of contemporary learning theories are, what Hager *et al*. (2012) call, the post-Cartesian theories of learning. They interpret learning as an ongoing, temporally changing process, that is intimately bound up with practice and change. Learning is emergent, situated in contexts and practices, cannot fully be decided upon, and is unpredictable. Moreover, rather than being given and static, contexts are seen as dynamic, constituted through practices, but also constituting practices themselves (Hager, Lee and Reich, 2012). Thus, PBA provides a more nuanced and complex way of conceptualising learning, by recognizing that practices are embodied, changing and relational and that they encompass both collective and individual learning (Reich and Hager, 2014).

The perspective on learning of PBA thus seem useful to understand the complex interactions between farmers' learning and learning of the SFI. Indeed, whereas traditionally learning is viewed as a linear process from expert to novice, the third group of learning theories "*view a person's practice as participation in a continually evolving process"* (Hager, Lee and Reich, 2012). Translated to this dissertation, the farmer thus becomes a participant in the continually evolving processes of an SFI. Using the words of Hager *et al*. (2012)*,* a farmer practitioner is then produced "*through participation in practices that shape skills, knowledge, understanding and disposition to action"* (Hager, Lee and Reich, 2012)*.* When small changes in the practice take place, they generate learning by the practitioners. These viewpoints stress the difficulty of talking about knowledge as if it was an object that can be transferred (Gherardi, 2009). In organizational studies, this evoked a shift of the term "knowledge" to "knowing", which implies an activity, a process, a collective and distributed doing (Gherardi, 2009). Orlikowski (2002), studying technology and technological practices, used the term 'knowing-in-practice'. This stresses that "*the competence of the individual in knowing how to get things done is both collective and distributed, grounded in the everyday practices of organizational members* (Gherardi, 2015)*"*. Moreover, learning not only changes the learner, but also its context (Hager, Lee and Reich, 2012). In this way, an SFI constitutes both the site for and the result of participation and learning (Nicolini, 2012; Gherardi, 2015). Or in Giddens' (1984) words: SFIs both constitute the medium and the result of recursively organized human action (Gherardi, 2015). They are a medium, "*because it is through its use that social conduct is produced, and an outcome because it*

is through the production of this conduct that rules and resources are reproduced in time and space (Mouzelis, 1989: 615; cited in: Gherardi, 2015)".

2.3.3 SFIs as a site for, and a result of, social practices.

In this research, we are interested in how SFIs can be described in terms of dynamics and characteristics of relevance to support on-farm sustainable development. We see potential in PBA in this pursuit. To our knowledge, limited research on sustainable farming initiatives explicitly used a practice-based approach as a framework. So far, the word or concept 'practice' is often taken for granted and only analysed to a limited extent (Reich and Hager, 2014). Using PBA, this means that we focus our research on the practice of SFIs. Taking Nicolini's "practice view" on organizations (2012), we use an inclusive perspective on practice and define SFIs as constituted of a collection of underlying activities, such as making sustainability development plans, organizing regular group meetings or field visits, that in other research could be regarded as practices themselves (Nicolini, 2012). According to PBA, these underlying activities are the result of the practitioners' agency to engage in the SFI and the shared meanings that allow the performance of these activities, without constant negotiation about what has to be done while participating in an SFI; i.e., SFIs are sustained by values, beliefs, norms, habits and discourses (Gherardi, 2015). Additionally, according PBA, also objects and material play a critical role in the reproduction of practices, as it makes practices durable and connects them across time and space (Nicolini, 2012).

Taking an SFI as the focus of our analysis has important implications. Or as Gherardi (2015) indicates: *"a practice does not stop at the boundaries of the organization; vice versa social practices extend into an organization* (Gherardi, 2015)". This means that some practices that are performed within an SFI, can also be performed outside an SFI and that practices that are present outside an SFI context can intrude in the SFI context. In this way we can construct an ecology of practices related to SFIs as presented in Figure 2-1. For example, farming practices are those practices that the SFIs aims to sustainably develop by supporting farmers on this regard. However, this group of practices is not exclusively bound to SFIs, and can also be influenced by non-SFI contexts. Through their aim to influence farming practices, SFIs are also related to practices of food production and market. Furthermore, practices of policy and regulation influence the practices performed in SFIs. Further, also insights from evaluation and research on SFIs can contribute to the development of SFIs. Otherwise, SFIs can contribute to extension and education for sustainable agriculture by generating knowledge.

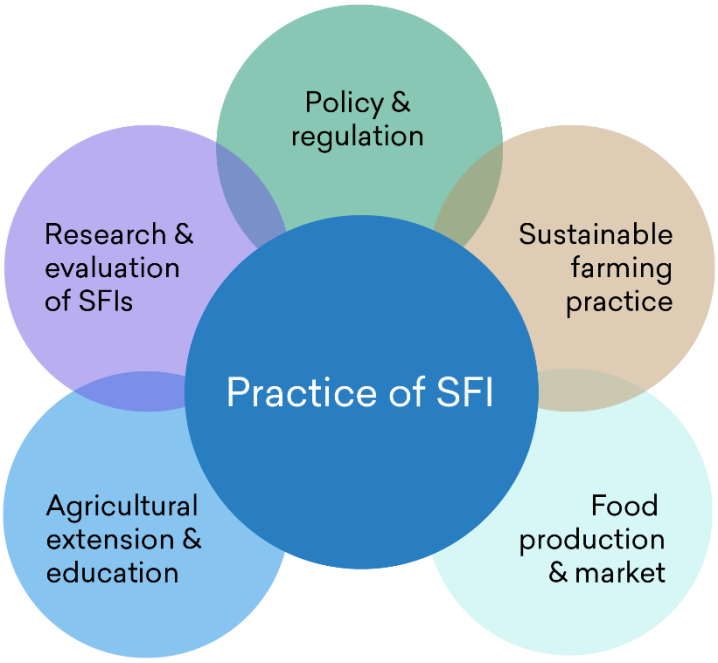


Figure 2-1. Ecology of practices related to SFIs.

The aim of this research is to come to design characteristics for SFIs that are successful in supporting farmers in on-farm sustainable development, i.e. that contribute to the deeper learning through their participation in the SFI. We will do this by investigating dynamics at play between participating farmers and the SFI. As discussed in section 2.1, we distinguish two major types of activities in the practice of SFI: the activities involving support for farmer learning and the activities related to governing an SFI. According to Nicolini's practice view on organizations (2012), the latter can be described as a particular form of activity aimed at ensuring that the social and material activities of an SFI work in the same direction.

As not many of the big practice theorists provided frameworks to use practice theory in empirical research, we were inspired by Crivits and Paredis (2013) and Oosterveer *et al*. (2007) who used practice-based approaches in the domain of consumption. Based on those researchers and the characteristics of practices described in previous sections, we propose a conceptual model of three highly interrelated components – routinized activities and human agency and agency of the material-functional and socio-cultural structure- that we use to describe the key dynamics and characteristics of SFIs successful in supporting on-farm sustainable development. First, routinized activities are the characteristic routines that take place/are being performed and make the SFI recognizable as an SFI. Given our rather inclusive account of practice, these thus constitute the recursive activities that constitute the practice of SFIs. These routinized activities, however, are always co-produced by the

interaction between human actors, a material-functional and socio-cultural structure. The human agency refers to the intentionality and ability of human actors to engage in (and change) the routinized activities (Crivits and Paredis, 2013). In this research, human agency thus refers to the actors' ability to engage in the activities of an SFI, and thus to contribute to a social learning process that results in outcomes both at the social level of the SFI and at the individual level. According to practice theory, besides the agency of humans, also so-called structural components contribute to the ability to perform a practice. Crivits and Paredis (2013), distinguish between the material-functional structure and sociocultural structure. The material-functional structure refers to things, artefacts, infrastructures and explicit procedures that contribute to the performance of the routinized activities. The socio-cultural structure, includes rather implicit elements such as norms, beliefs and discourses (Crivits and Paredis, 2013).

In this dissertation, our main interest is farmer participation in SFIs that contributes to the deeper learning on on-farm sustainable development (see section 1.3). Translated to this conceptual framework, we are thus mainly interested in the agency of farmers to engage in the routinized activities of an SFI, and to contribute to and engage in a social learning process. The above described interplay between the components of routinized activities, human agency, material-functional structure and socio-cultural structure, show that this farmer agency is not merely individually defined, but depends on the performance of the practice of the SFI as a whole, and thus also the other practice components. So, based on these insights, we will use a PBA to define components of the SFI practice that contribute to farmer agency to engage in the SFI practice. This is graphically represented in Figure 2-2.

In Chapter 7, we will test the effectiveness of this PBA conceptual framework, by using it to further articulate the findings from our empirical chapters and to obtain a richer picture on the key dynamics and characteristics related to participation and learning in SFIs. In the table below, we give an overview of the four perspectives we use in this research and how the way we use their concepts can be related to the three levels related to SFI as referred to in section 2.1, the level of the individual, SFI and context.

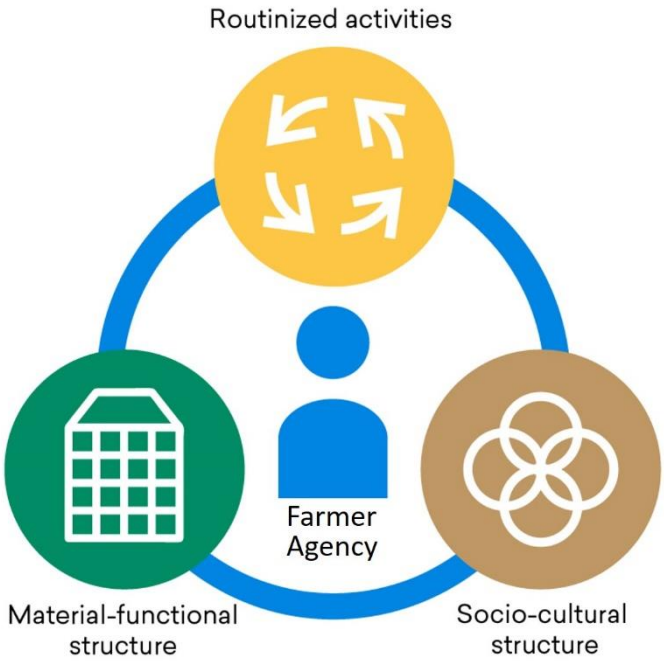


Figure 2-2. Conceptual framework to investigate farmer agency to engage in SFIs, using a practice-based approach

Table 2-1. Overview of relation between the concepts of the four perspectives we use in this manuscript relate to the individual farmer level, the SFI level and the context-level.

Theoretical Perspective	Individual farmer	Sustainable farming initiative (SFI)	Context
Self-determination Theory	Growth oriented individual with a motivational orientation towards participation in SFI activities	Participation context in which farmers participate.	/
Communities of Practice	Member of the learning community, who learns through interaction with other community members	Community of practice in which groups of people who share a concern or passion about a topic, deepen their knowledge and expertise by interacting.	/
Cultural-historical activity theory	An agent in activity systems	Collective, object-oriented and artefact mediated activity system	The activity system of the SFI is, through its object, connected to other activity systems, thus creating a network of activity systems that mutually influence each other.
Practice-based approach	Agent performing and changing the practice	A practice that is characterized by routinized activities, and that is performed by means of the interplay between agency, material-functional structure and socio-cultural structure.	They are shaped by historically given conditions that relate to time and space and discourses and norms prevalent in other related practices.

2.4 Three cases

Besides the case of our own research unit, i.e. the development of the sustainability assessment tool MOTIFS, we also selected three cases of SFIs that are based on active farmer participation: *Veldleeuwerik* ('Skylark'), *Beloftevol Boeren* ('Promising Farming'), and DAIRYMAN. The selection of cases resulted from the diversity of SFI-types we observed, e.g., regarding its initiator, the tools used, the number of participants and its longevity (Table 2-2). Further, we also chose to focus on cases that were already actually supporting farmers in the sustainable development of their farm. For example, although a new initiative of the farmers' union in Flanders was promising, we did not further investigate this case, as it never reached further than the development stage of a sustainability assessment tool (similar to MOTIFS). Our connections with some of the cases also might have influenced our choice. How we came aware of each of our cases' existence is described in the following paragraphs for each case. The author of this manuscript was not actively involved in each of the SFIs. Her role in these SFIs' activities was limited to that of an observer through which information on the cases was gathered. We will only give a short introduction on these cases here, because they will be thoroughly discussed in the following chapters. Also the methods for data collection are explained in detail in the following chapters.

MOTIFS is an initiative that originated within the Stedula research group (Steunpunt Duurzame Landbouw) and was further developed within our research group. The first aim was to scientifically develop a way to operationalize sustainability in Flemish agriculture, and Stedula focussed their research on optimizing sustainability assessments. They aimed to develop a sustainability assessment tool, MOTIFS, that was useful for both Flemish policy makers and Flemish farmers. During these years of research and tool development, questions arose on the quantitative measurability of some aspects of sustainability, the usefulness of the tool, and the limited adoption in practice. At the time of writing this manuscript, the tool as a whole is no longer used. Separate indicator sets for specific sustainability themes, such as crop protection and entrepreneurship are further developed and used to a limited extent. Insights grew that a more systemic perspective is needed for achieving sustainable development within Flemish agriculture, that (social) learning is an important aspect in this process, and that the sustainability tools are only an aid in the learning process required for sustainable development on farms. In this way, the MOTIFS case in this manuscript has another baseline than the other selected cases. Whereas the development of MOTIFS initially was aimed to monitor sustainability, the other three cases Veldleeuwerik, Beloftevol Boeren and DAIRYMAN were much more set up with the basic idea of knowledge sharing and social learning on sustainable development in farmer groups.

Veldleeuwerik is a Dutch SFI initiated in 2002 by a brewery and 10 arable farmers. Their aim is to establish on-farm sustainable development and facilitate sustainable arable food chains. They enhance knowledge exchange between farmers and between farmers and other actors in the supply chain. The basis for on-farm sustainable development is the use of farm sustainability plans and farmer group meetings. Currently, more than 400 farmers and 25 chain partners are involved. We came into contact with this case, through their request to exchange knowledge on our research group' experience with sustainability assessment tools.

Beloftevol Boeren, was situated in West –Flanders and started as part of an Interreg project (Duragr'ISO; 2009-2012) and was coordinated by a Flemish agricultural research institute from 2009 until 2017. The aim of this initiative was to implement an ISO14001-method for sustainable development in farm management, developed in France, on farms in the Province of West Flanders. The initiative experienced difficulties in its continued existence after the Interreg-project ended and finally ended in 2017. In total 10 farmers have been involved. We were aware of Beloftevol Boeren's existence because they considered to use the MOTIFS tool in the initial stage of their project and there were some contacts with members of our research group.

DAIRYMAN (INTERREG NWE, 2009-2013), was an European Interreg IV-project, in which networks for knowledge exchange and creation about sustainable dairy farming were set up in 10 regions in North West Europe covering 7 countries in Europe. They comprised 130 commercial pilot dairy farmers, 9 Knowledge Transfer Centres (i.e. either experimental farms or agricultural schools on which technical research was performed and disseminated), research institutions, advisory services and policy makers in 10 regions. Our research unit was involved in this project which provided us a good view on the different regional networks and how they differed from the Flemish case. As we were mainly interested in the influence of the structure and activities on farmers' learning, we chose both Northern Ireland and Flanders as specific DAIRYMAN-cases because their approach differed to a great extent. After the project funding ended, the networks did not further continue.

Table 2-2. The selected SFIs for this research

Features	Veldleeuwerik	Beloftevol Boeren	DAIRYMAN
Duration	2002 - ongoing	2009 - 2017	2009- 2013
Initiators	Brewery, intermediary firm, farmers	Agricultural research institute	Researchers
Location	The Netherlands	Province of West Flanders (Belgium)	10 North-western European regions
Max. number of farmers	400	10	130
Agricultural focus	Arable farming	Not specified	Dairy farming
Relation with our research group	Few meetings on sustainability assessment tools	Considered to use MOTIFS in early stages of the project	Our research group participated in the regional network of Flanders

2.5 Structure of the following Chapters

We have introduced the challenges that brought us to this research in Chapter 1 and framed our research approach in Chapter 2. This section describes the content of the following Chapters in this dissertation, and how they can be pictured in the framework of our research (Figure 2-3).

Chapter 3 contains the paper that set the scene for this research. This research stems from the difficulties our research group experienced in the pursuit to contribute to on-farm sustainable development in Flanders. Our research group rather naively aimed to implement a scientifically sound, regional and sector specific sustainability assessment tool to support on farm sustainability management in Flemish agriculture. However, as with many tools developed by scientists, its actual adoption by farmers and farm advisors failed. Eager to find out what went wrong, we evaluated the development process of the tool, confirming the need to shift towards a more systemic perspective on knowledge creation and extension services for farmers and a shift in the role and attitude of researchers, also in Flanders (cfr. Section 1.2).

Chapter 4, 5 and 6 answer the specific research questions 2.1-2.3, that focus on specific dynamics within an SFI (see section 1.4).

Chapter 4 addresses the research question: *RQ 2.1. What is the motivation of participating farmers to participate in voluntary SFIs, and how is this motivation influenced by the participation context created by the SFI?* We argue that for SFIs being able to exist, they require that farmers are motivated to participate in the activities of the SFI. In this Chapter, we take an rather individual centred perspective by using SDT to understand why farmers participate in an SFI, what motivated them to join in the first place and how they are motivated to keep on participating. Further, SDT allows to predict the engagement in SFI activities based on the quality of the farmers' motivation. By using SDT on the case

Veldleeuwerik, we try to link the type of motivation to specific characteristics of the SFI. Referring to our simple framework of nested levels described in section 2.1., this Chapter thus tries to explain the dynamic of participation taking the individual farmers as an entry point, but without neglecting the interaction with specific characteristics of the SFI.

Chapter 5 addresses the research question: *RQ 2.2. How do different design characteristics contribute to perceived value creation for farmers?* In this Chapter, we are interested in how the activities aimed at knowledge co-creation in the DAIRYMAN case were of value for farmers. By using the CoP/VCF-perspective, we approach the individual farmers within the social environment of the SFI and see learning as the outcome of the social interactions for farmers. We thus take the social interactions of the SFI in which the farmers participate as entry point.

Chapter 6 addresses the research question: *RQ 2.3. Which organizational dynamics contribute to the development of an established SFI?* This Chapter compares the developmental process of two cases, *Beloftevol Boeren* and *Veldleeuwerik*, which significantly differ in their success to support farmers in their on-farm sustainable development. By using CHAT, we use a more integrative approach in which participants in the SFI are viewed as concerted agents in an activity system that is constituted of multiple interacting elements. We focus on contradictions between the elements of the SFI activity system as the driving force in its development. Learning is conceptualised on the social level of the activity system, and is interpreted as an outcome of a process to overcome the contradictions within the activity system. As such we take a systems perspective on the SFI as entry point, to understand their developmental and learning process.

In Chapter 7 contains two main sections. First, we try to articulate our findings from Chapter 4 to 6 to obtain a richer picture on the dynamics at stake in SFIs related to farmers participation. To do so we use a practice-based approach. In this way, we try to answer the overall research question RQ3 on key dynamics and characteristics for SFI design that successfully facilitate farmers' learning for on-farm sustainable development. Second, we critically discuss the value and limitations of the chosen perspectives for answering our research questions and our overall research approach, to come to suggestions for further research.

In Chapter 8, we conclude with key recommendations for SFI design directed to actors involved in the design and development of SFIs.

Figure 2-3. Structure of the following chapters in this dissertation.

CHAPTER 3.

Setting the scene: Reflection on the development process of a sustainability assessment tool

The research performed in this Chapter set the scene for this dissertation. It stems from the difficulties that our research group experienced in the pursuit to contribute to on-farm sustainable development in Flanders. Our research group rather naively aimed to implement a scientifically sound, regional and sector specific sustainability assessment tool to support on farm sustainability management in Flemish agriculture. However, as with many tools developed by scientists, its actual adoption by farmers and farm advisors failed. Eager to find out what went wrong, we evaluated the development process of the tool, which confirmed the need to shift roles and attitudes of researchers in knowledge creation in the context of sustainable agriculture (cfr. Section 1.2).

This Chapter is based on following published paper:

> Triste, L., Marchand, F., Debruyne, L., Meul, M., & Lauwers, L. (2014). Reflection on the development process of a sustainability assessment tool: learning from a Flemish case. Ecology and Society, 19(3).

3.1 Introduction

Over past decades, many sustainability assessment tools have been developed for agriculture to assist stakeholders in identifying and evaluating sustainable development. Sustainability assessment is viewed as a significant aid in the transition towards sustainable development (Pope, Annandale and Morrison-Saunders, 2004). Assessment tools have been developed for various levels of the food production system, i.e. farm, regional, national, or global (Bockstaller and Guichard, 2009; Binder, Feola and Steinberger, 2010). Because of the complexity of food production systems, different types of tools have been developed (de Ridder *et al.*, 2007; Binder, Feola and Steinberger, 2010; Van Passel and Meul, 2012), ranging from indicator sets (e.g., Girardin *et al*., 2000; Rigby *et al*., 2001; Zahm *et al*., 2008; Grenz *et al*., 2011) to simulation models (e.g., Cerf *et al*., 2012; Van Meensel *et al*., 2012). These tools make complex sustainability issues more tangible, and therefore

support decision making at the abovementioned levels (e.g., Halberg *et al*., 2005; Castoldi and Bechini, 2010; Van Passel and Meul, 2012). However, concerns arise about translating this potential into actual use by intended users (McCown, 2001; Woodward *et al*., 2008; Díez and McIntosh, 2009; De Mey *et al*., 2011; Cerf *et al*., 2012).

One critical success factor is the research and development process that ultimately leads to the tool (Weaver and Rotmans, 2006; Reed, 2008; Bell *et al*., 2012; Pülzl *et al*., 2012). Many of these processes are iterative learning processes with non-linear links between goal definition, design and implementation (Woodward *et al*., 2008). Insufficient involvement of stakeholders and end users during the development process can lead to failure in practical use of the tools (Woodward *et al*., 2008; Cerf *et al*., 2012; Prost *et al*., 2012; Van Meensel *et al*., 2012). This is especially applicable to sustainability, a context-bounded concept that needs to be interpreted and implemented by a range of stakeholders (Weaver and Rotmans, 2006). Despite recommendations in literature about best practices, insight is still lacking about how participants engage in participatory processes and how this affects the process' outcomes, e.g., tools (Bell *et al*., 2012). The scarce scientific attention to the design methodology of tools is a possible reason (Prost *et al*., 2012). However, some interesting contributions have been made specifically on participatory tool design (e.g., McCown *et al.,* 1998; McCown, 2001; Cerf *et al*., 2012; Prost *et al*., 2012; Van Meensel *et al*., 2012).

Scientific identification of factors hindering tool adoption in actual practice is challenging. Difficulties not only stem from the complex concept of sustainability, but also from the lack of literature about the development process of sustainability assessment tools. Because of the multiple facets inherent to the development process, many process factors are expected to influence tool adoption. Structured reflection on the process is therefore necessary to increase insight in determining factors. Blackstock *et al*. (2007) suggested to perform reflection with a team of evaluators both involved and not involved in the development process. The first contribute to understanding insider information on the process, the latter tackle the risk of being interpretative and self-referential while performing the reflection.

The aim of this Chapter is to perform a reflection on the development process of a sustainability assessment tool that was not adopted for practical use to the desired extent. We chose MOTIFS, "Monitoring tool for integrated farm sustainability"(Meul *et al*., 2008). The development process of MOTIFS is soundly documented in literature and well known by three authors of this Chapter who were involved in the development process. Earlier tool evaluations by Meul *et al*. (2009), Campens *et al*. (2010) and De Mey *et al*. (2011) have

already suggested improvement strategies for MOTIFS and its implementation. However, these did not result in the intended and general adoption by farmers or farm advisors. The goal of this reflection is to foster a scientific debate on the development and implementation of sustainability assessment tools by identifying characteristics which either stimulate (i.e. success factors) or hinder (i.e. barriers) the general adoption by the intended end users. These insights must contribute to our learning for future tool development.

This Chapter is arranged as follows. First, we briefly introduce the MOTIFS case and discuss our methodological approach for the reflection process. We then examine the results of this reflection process in light of barriers and success factors that influenced the general adoption of MOTIFS. Finally, we discuss lessons learned from these results and present our conclusions.

3.2 Methodology: Reflection on a Flemish case

3.2.1 The MOTIFS case

MOTIFS is an indicator-based sustainability assessment tool that presents a visual aggregation of indicator scores in a radar graph (Meul *et al*., 2008). It covers 10 sustainability themes related to ecological, economic and social aspects and is an example of a scientifically sound indicator-based tool developed for general use by farmers or farm advisors. Despite the participatory tool development process, involving a wide range of stakeholders, adoption of the tool was disappointing. At the time of writing this thesis the tool as a whole is no longer used. Separate indicator sets for specific sustainability themes, such as crop protection and entrepreneurship are further developed and used to a limited extent. To learn from this outcome, we reflected on the process from tool design to implementation.

3.2.2 Framework of reflection

We followed a reflective approach to take full advantage of our inside information related to this process. To avoid the pitfalls of being interpretative and self-referential, we built our reflection process according to Blackstock *et al*. (2007). Their framework is designed for evaluating participatory research and builds on three bodies of literature, which concern participatory research, sustainability science and evaluation of partnership processes (Figure 3-1). Central to the approach is an evaluation process emerging from four aspects delineating the object of evaluation: bounding, focus, timing, and purpose. The evaluation process itself concerns: selection of evaluation criteria, choice of a methodology to gather and analyse data, and selection of the evaluation staff.

3.2.3 Bounding, focus, timing, purpose

Bounding serves to clearly delineate the object of the evaluation, which makes it easier to keep the evaluation process on track. The object of our reflection is the MOTIFS tool development process from the early beginning (visioning phase) to the different attempts for implementation. The focus of an evaluation can be either strategic, investigating if the project achieves the objectives, or operational, investigating time, costs or quality of the activities (Blackstock *et al*., 2007). Our research objective, i.e. elucidating characteristics of the MOTIFS development process that influenced the tool adoption, makes our focus strategic. Our reflection is situated two years after the MOTIFS process has been put on hold, making it an *ex post* evaluation. Blackstock *et al*. (2007) mentioned four purposes for evaluation: proving, controlling, learning and improving. We wish to contribute to the insights in literature about tool development processes and our learning on tool development for subsequent improvement of existing tools and designing better tools. Therefore the central purpose of this evaluation can be described as *learning* and *improving*.

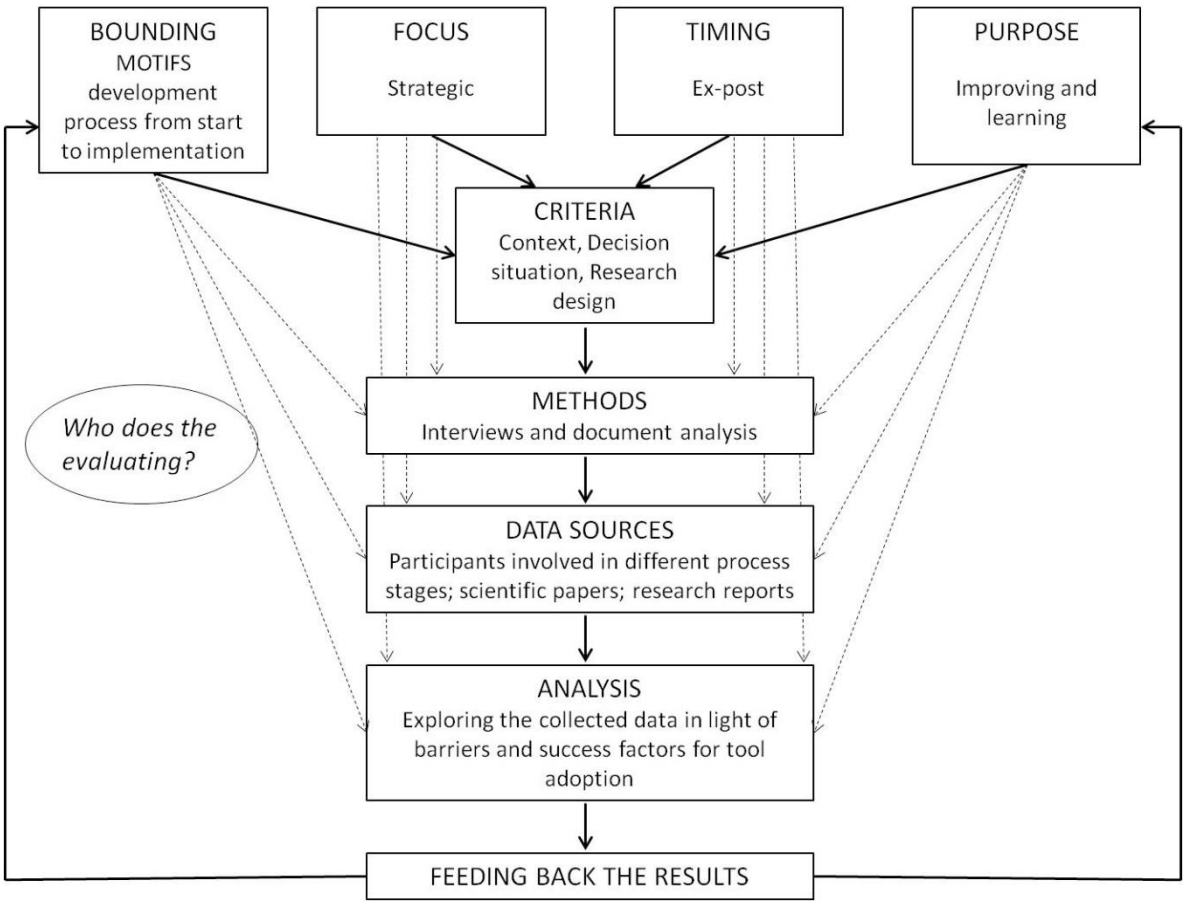


Figure 3-1. Reflection framework for the MOTIFS case, based on Blackstock *et al*. (2007).

3.2.4 Evaluation criteria

Evaluation of a process needs evaluation criteria selected with reference to the type of evaluation employed and the objectives for which the evaluation is being carried out (Blackstock *et al*., 2007). Blackstock *et al*. (2007) mentioned the importance of choosing the criteria, as there are often no acceptable, valid and reliable quantitative measures for the variables of interest. Due to this lack of predefined variables, we preferred to leave room for criteria emerging from our data. Therefore, we limited our *a priori* selection of evaluation criteria to what we call main fields of criteria. This prevented us from being limitative and overlooking important criteria. Our main fields of criteria are based on Burgess and Chilvers (2006) and Blackstock *et al*. (2007) who have emphasized the connection between the outcome of a process and its underlying context, research design and decision situation. As a result, we selected the following main fields of criteria: (i) the political, social, cultural, environmental context in which the process took place, (ii) the decision situation comprising the starting points for the research design (e.g., objectives set or principles adhered to during the process), and (iii) the research design, relating to the process set-up from tool design to implementation.

3.2.5 Methods, data sources and analysis

We used a qualitative research approach (Denzin and Lincoln 2000, Creswell 2003) that combines data from scientific literature, reports and interviews (Figure 3-2). The scientific papers and research reports concerning MOTIFS (Mathijs *et al*., 2004, Mulier *et al*., 2004; Nevens *et al*., 2008; Meul *et al*., 2008; Meul *et al*., 2009; Campens *et al*., 2010; De Mey *et al*., 2011) were analysed (i) to identify the initial objectives set for the tool and (ii) to reconstruct the course of the process from design to implementation. In addition, we carried out in-depth interviews with people involved in the MOTIFS process to gain more specific details about the selected fields of evaluation criteria that did not emerge from existing MOTIFS publications (our interview guide is included in Annex 1). We interviewed 12 researchers involved in different stages of the process and one person only involved in MOTIFS' practical implementation. Farmers and farm advisors were not included as their experiences were already described and analysed in Meul *et al*. (2009) and De Mey *et al*. (2011). Each interview was recorded and transcribed.

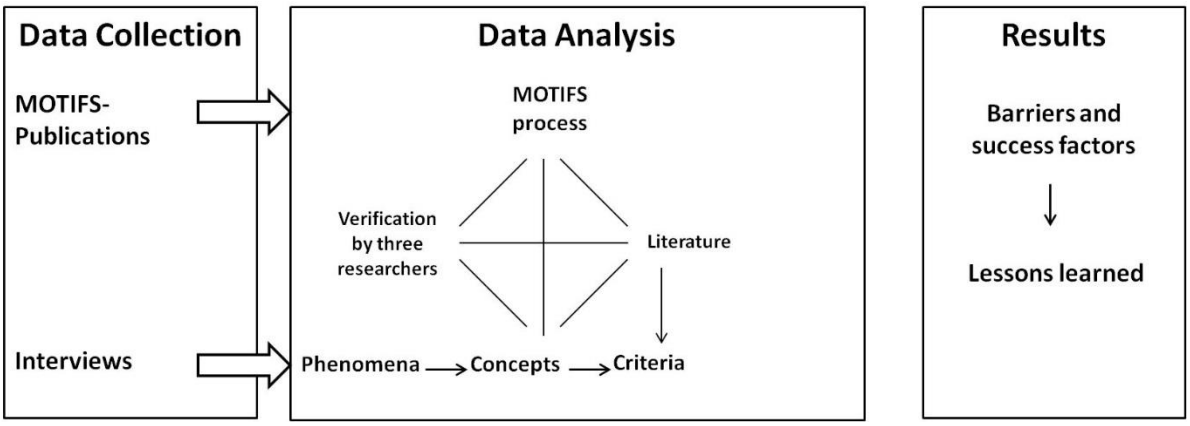


Figure 3-2. Methodology for reflection on the MOTIFS development process.

To guarantee that the selected fields of evaluation criteria were addressed during the interviews we used an interview guide (Marchall and Rossman, 2006). To gain insight into the context of the MOTIFS process, we asked questions about why and how the project started, what their and society's expectations were, how they thought farmers can become more sustainable, etc. Questions covering the decision situation gathered information on the rationale behind the development of MOTIFS, on their definition of sustainability, on their thoughts about the usefulness of tools to increase agricultural sustainability and what these tools should look like. To gain insight in the research design of the MOTIFS process, we asked about the set-up of the research design, the stakeholders involved during the process, the respondent's opinions on and experiences with the research set-up, the barriers and success factors they perceived during the process, and what they learned about it for future projects.

We analysed the interview transcripts in NVivo 9 (QSR International, 2010), enabling us to structure, label and classify the qualitative data. We used the method of coding described by Strauss and Corbin (1998), based on researchers' expertise (Rogge *et al*., 2011, Kerselaers *et al*., 2013). First, the data were broken down into *phenomena,* transcript fragments representing discrete incidents, ideas, events or acts mentioned by the interviewee and relevant to our research. Each phenomenon was labelled to enable grouping of similar phenomena under a common heading. Each phenomenon mentioned by two or more respondents was defined as a concept. Concepts were classified into categories, and linked to the different fields of evaluation criteria. We illustrate this coding process with following example. The quotes "Farmers were underrepresented. Seldom a farmer sat around the table" and "Stakeholders were mainly experts" were indicated as phenomena. Both phenomena were defined as the concept "Experts dominated advisory boards during tool development". This concept was classified into the category "Stakeholder

involvement and roles" and linked to the evaluation criterion, "Research design". For further details on this method see De Mey *et al*. (2011).

3.2.6 Research validity and evaluation staff

In qualitative research we need triangulation to ensure objectivity throughout the data collection and analysis (Strauss and Corbin, 1998; Patton, 2002). In our case we applied the following triangulation techniques:

- Data triangulation, by using different sources or types of respondents (e.g., researchers involved only in the beginning, at the end or throughout the whole MOTIFS process).
- Methodological triangulation, by using multiple methods to gather data (the use of published scientific papers, research reports and interviews)
- Investigator triangulation, by balancing between key informants and evaluators who have not been involved in the process, to ensure important issues are not hidden or ignored (Blackstock *et al*., 2007). The authors of current reflection on the MOTIFS process, consist of two people not involved and three involved in the process (two of them were also interviewed). The interviews were conducted by the authors not involved in the process. Coding of the interview transcripts was performed by three authors, one of which was involved in the process. These authors thoroughly discussed the results of the data analysis and the translation into lessons learned.

3.3 Results

Table 3-1 presents an overview of detected barriers or success factors according to the predefined main fields of evaluation criteria. They are grouped into three clusters of learned lessons, which will be addressed in the discussion section. Often, similar lessons can be learned from different barriers and success factors.

3.3.1 Context

In 2001, two leading Flemish academics and a chief of the policy staff published a vision text called 'Future vision on sustainable agriculture in Flanders' (Mathijs *et al*., 2004). At that time, common knowledge about agricultural sustainability was rather limited in Flanders. Therefore, the Government of Flanders decided to found Stedula (2002-2006), the Flemish Policy Research Centre for Sustainable Agriculture, one of the first Flemish initiatives to enhance sustainability in agriculture. The mission of this inter-university research group was outlining the relevant topics for a sustainable agricultural sector,

establishing objective and achievable goals, and developing an appropriate indicator set. That indicator set should enable government to monitor and evaluate the state of sustainability in agriculture and the efficiency of policies and measures (Nevens *et al*., 2008).

According to respondents, society's knowledge about agricultural sustainability changed. Insufficient communication between Stedula researchers and the wide range of stakeholders directly and indirectly involved in Flemish agriculture, in combination with changing insights of both parties, resulted in divergent expectations of the researchers and stakeholders concerning the outcome of the Stedula research. For example, while Stedula researchers recognized that making sustainability concrete was far more complex than initially expected (e.g., unequal knowledge about the three pillars of sustainability resulted in the absence of good social indicators), they felt that stakeholders still expected a solution for all problems in agriculture within a single tool. We consider these divergent expectations as a barrier to the successful design and implementation of MOTIFS.

The broad mission set for the Stedula research team was another barrier resulting from the originally limited knowledge on sustainable agriculture. As mentioned by the respondents, this probably has led to the formulation of very diverse project objectives. When asked about the tool's purposes, respondents described a range of applications. Their answers varied from measuring sustainability on farms, to measuring agricultural sustainability in Flanders, to a tool to encourage and motivate farmers to increase on-farm sustainability. This resulted in diverse potential functions and end-users for MOTIFS. Consecutive implementation projects (Schoonhoven, 2008; Meul *et al*., 2009; De Mey *et al*., 2011; Meul *et al*., 2012) show an evolution in MOTIFS' function from a monitoring tool to a communication tool, and finally a decision support tool. Figure 3-3 illustrates this evolution, giving pros and cons for each function.

The confusion about the tool's objectives was further complicated by changes in the research team. The most abrupt change occurred in 2007 when the Stedula project transferred to the Institute for Agricultural and Fisheries Research (ILVO). This resulted within the research team in both discontinuity of knowledge and changing visions and interpretations of, for example, the tool's purpose. The limited experience of new researchers with the tool and the lack of documentation about previous decision-making, made it difficult for them to agree on the tool's purpose. The research team coordinators also changed more than once. This was probably one reason for the lacking necessary decision-making about the objectives for tool development.

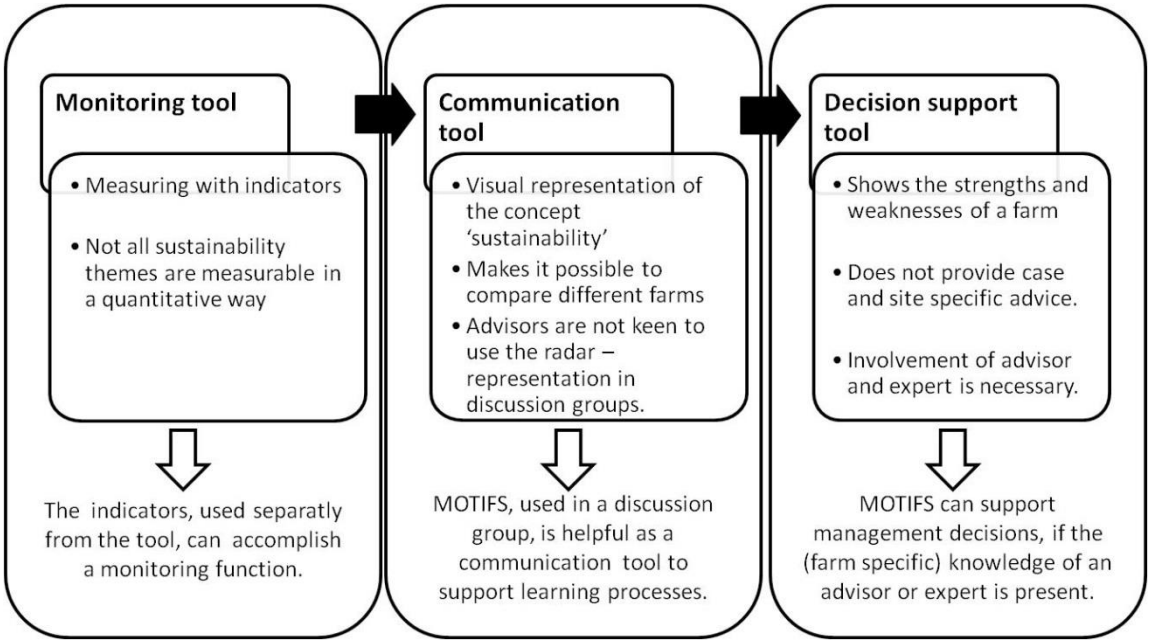


Figure 3-3. Evolution in MOTIFS' functions (in the white boxes: pros and cons per function; under the white boxes: the way MOTIFS can be used for each function).

Table 3-1. Barriers and success factors for MOTIFS' adoption in practice.

Criteria	Categories	Concepts	Success factor (S) or barrier (B)	Lessons learned[6]
Context				
	Society's initial common knowledge about sustainability in agriculture	Changing insights and expectations	(B) Divergent stakeholders and researchers expectations	1, Need for good communication between researchers and stakeholders on changing insights.
			(B) Absence of clearly defined tool objectives	2, Set straightforward, unambiguous objectives for the development process.
				3, Need for clear reflection and decision-making within the research team.
			(B) The process resulted in a tool with diverse potential functions and end users	4, A tool can have multiple functions.
				5, A tool can have multiple end users
				2
	Institutional changes	Changes in research team composition	(B) Discontinuity of knowledge and changing visions and interpretations	3
				6, Need for motivating and documenting decisions.
				7, The coordinator of the team can play an important role in encouraging decision-making, evaluation and vision alignment within the team.
Decision situation				
	Equality of economic, ecological and social sustainability	Choice to develop a holistic tool	(S) A holistic tool is able to raise farmers' and society's awareness about sustainability.	2
			(B) A holistic tool is less valuable for farm practice.	2
		Team composition	(S) Variety of expertise in team	8, A diverse research team favours knowledge creation on sustainability.
			(B) Underrepresentation of social scientists in research team	8

[6] The numbers in this column refer to the lessons learned. For each new lesson mentioned in this column a number is given. When the same lesson also counts for other success factors or barriers, only the number is repeated without the caption.

Criteria	Categories	Concepts	Success factor (S) or barrier (B)	Lessons learned
Decision situation				
	A scientifically sound interpretation of sustainability	Development of a monitoring tool, based on quantitative indicators	(B) Difficulties in capturing social sustainability in a quantitative way, thus undermining the monitoring purpose of the tool.	2
				4
				8
	Definition of sustainability as a dynamic concept	Changing context and insights were insufficiently incorporated into the tool.	(B) Lack of communication within research team and with broad stakeholder group	3
				9, Set up frequent communication between researchers and stakeholders.
Research design				
	Stakeholder involvement and roles	Stakeholders were not involved at the very beginning of the development process.	(B) Lack of information about the stakeholders' support for an indicator based tool.	10, Need for well thought out stakeholder selection for the different process stages.
			(B) Lack of information about the end users' demands for the tool.	11, Need for early end user involvement in tool development.
		Experts frequently dominated advisory boards during tool development.	(B) Difficulties in balancing precision, efficiency, transparency and user friendliness of an indicator.	10
		Late involvement of end users in the development process.	(S) Optimization of use and implementation settings of the tool.	12, Importance of the implementation setting of the tool.
			(B) Difficulties to make optimizations on the tool itself.	11
			(B) Farmers not willing to use the tool by themselves due to lack of user friendliness.	11
	Researchers experiences	Variety of stakeholders involved.	(B) Researchers experienced difficulties in managing differences between stakeholder groups.	13, Need for competent facilitators supporting knowledge interchange between stakeholders.
	Tool implementation	The tool functions, end users and implementation settings evolved during the development process.	(B) The tool shows shortcomings for the different end users and functions.	14, It is difficult to combine different tool functions in one tool.

3.3.2 Decision situation

Stedula's research started from a vision and a definition of principles about sustainability. Together with the abovementioned Stedula objectives, they form the decision situation of the development process that influenced the research design.

The principle to equally and simultaneously incorporate economic, ecological and social sustainability dimensions (Nevens *et al*., 2008) resulted in the development of a holistic tool. According to the respondents, the major success factor of such a tool is its ability to raise awareness about the holistic concept of sustainability. Other respondents question the value of a holistic tool for farm practice. They argue that some sustainability issues are not suitable for monitoring at farm level and that simultaneous implementation of the three dimensions in one tool for management and monitoring purposes is seldom performed in practice. This holistic principle guided the variety of expertise in the transdisciplinary research team, creating a success factor for knowledge building. The research team consisted of agronomists, veterinarians, economists, anthropologists, and geographers. But the composition of the research team was not proportionate with the three sustainability dimensions. Social (1 anthropologist, 2 social geographers) and economic (2 economists) scientists were less represented in the overall team compared to scientists with an environmental background (16 agronomists, 1 veterinarian). This barrier may have resulted in the failed development of social indicators.

The objective of Stedula to provide a scientifically sound interpretation of sustainability probably resulted in a focus on the development of quantitative indicators and the choice to develop a monitoring tool (instead of, for example, guidelines to enhance social sustainability on a farm). According to respondents, this decision was spurred by the government's preference for quantifying progress and the prevalence of natural scientists on the team. However, the social scientists questioned this approach, because they believed some social issues require a qualitative approach. During the development process, the research team encountered difficulties in the quantitative expression of some sustainability themes. This resulted in an incomplete indicator set, which undermined the tool's holistic monitoring purpose and led part of the research team to change its vision of the tool's purpose from monitoring to decision support tool.

The definition of sustainability as a dynamic concept resulted in the aim to develop MOTIFS as a dynamic tool, i.e., a tool that requires continuous adaptation to new data and changing contexts. During the MOTIFS process, the changing context and insights were insufficiently translated into the tool (see also Context, above). Closer involvement of a

broad stakeholder group throughout the process could have increased the researchers' awareness of a changing context (and stakeholders' needs).

3.3.3 Research design

In 2005, Stedula developed an updated vision of the original vision text of Mathijs *et al*. (2004) on agricultural sustainability in Flanders, entitled 'On tomorrow's grounds'(Nevens *et al*., 2008). They used a multi-stakeholder, transdisciplinary approach with involvement of a wide range of stakeholders directly and indirectly engaged in Flemish agriculture (farmers and representatives of farmers' organizations, scientists, government representatives, suppliers, education, NGOs, countryside, consumers, distribution, and food processing; Nevens *et al*., 2008). The researchers considered MOTIFS as the strategy for realizing this vision's objectives, by monitoring farm progress towards integrated sustainability in terms of economic, ecological and social aspects. Because of the time lag between the supported vision development in 2005 and the start of the tool development in 2002, stakeholders' input was lacking at the very beginning of the MOTIFS development process. This could have led to a barrier because researchers missed information about (i) the stakeholders' support for the development of an indicator based tool for Flemish agriculture and (ii) any potential demands of the intended end users (farmers or farm advisors) for such a tool.

Experts and intended end users (often representatives of farmers' organizations) were involved during tool development for indicator selection, design and validation by participating in advisory boards (see Meul *et al*. (2008) and Meul *et al*. (2009) for more information). However, experts frequently dominated the advisory boards. The researchers perceived this inequity as a barrier contributing to difficulties in balancing precision, efficiency, transparency and user friendliness of an indicator. In addition, some researchers experienced difficulties in managing different stakeholder groups during tool development, because of the stakeholders' varying backgrounds and ways of thinking and communicating.

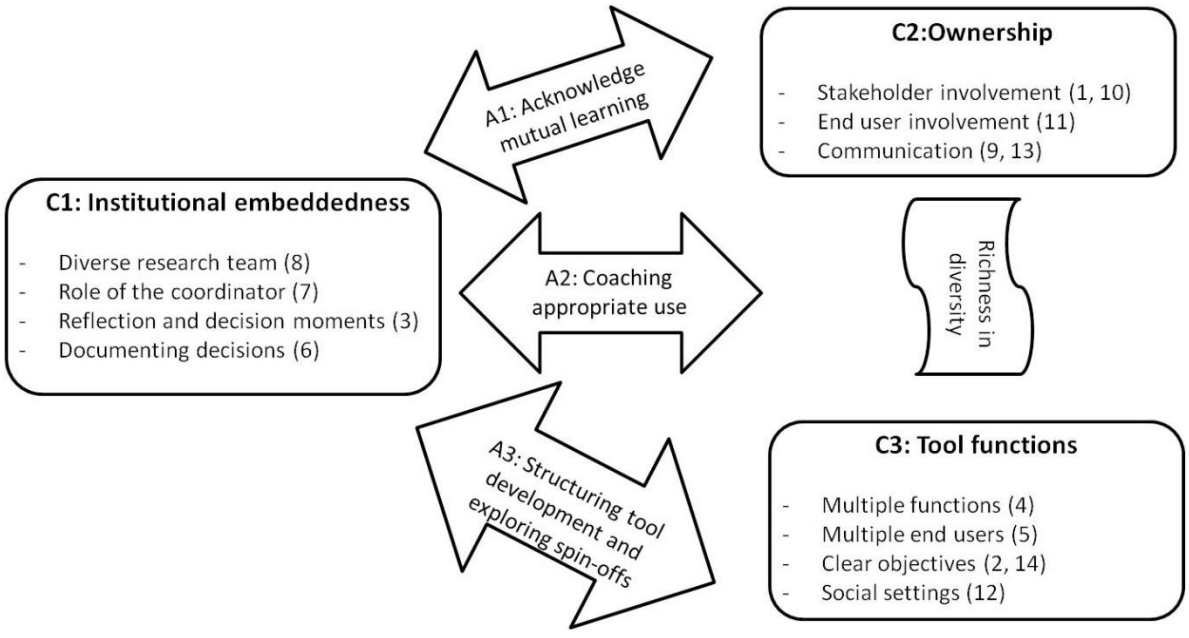
During the implementation phase of MOTIFS' development, farmers and farm advisors were involved to a greater extent. During the first implementation and validation (Schoonhoven, 2008; Meul *et al*., 2009), farmers indicated they were reluctant to use the tool because they perceived it as not user-friendly. They felt it was time consuming, complicated, unable to deliver concrete farm advice, and sometimes difficult to interpret. However, they appreciated the use of the tool in discussion groups in presence of an expert. Because of its advanced state, adjustments to the tool itself were not considered as an option. As Mulier *et al*. (2004) and Meul *et al*. (2009) show, this resulted in a shift in the tool's intended end users and implementation settings (Figure 3). At the start of the process,

the researchers wanted to design a tool to be used by farmers independently, but, due to the aforementioned insight, MOTIFS shifted towards a tool enabling discussion in farmer groups supported by an expert or farm advisor (De Mey *et al*. 2011, Meul *et al*. 2012). Earlier involvement of farmers in the development process could have facilitated adjustments to the tool itself and not only in the targeted end users and implementation settings.

Farm advisors also experienced difficulties using the tool. Respondents identified the following main barriers for adoption by farm advisors: (i) the necessary data are not always readily available, particularly for ecological and social themes, (ii) underlying indicator calculations are complex and not always transparent, for example, assumptions made were not always clear, (iii) MOTIFS' design was not applicable on the whole range of farming systems in Flanders, and (iv) guidance for farm advisors to adopt the tool in their practices was lacking.

3.4 Discussion

The barriers and success factors of the MOTIFS development process described in the results section were translated into lessons learned (Table 1). Figure 4 shows the relationships between these lessons. We grouped them into three clusters: (C1) institutional embeddedness, addressing the researchers' role in the development process, (C2) ownership, addressing the stakeholders' role in the process, and (C3) tool functions.



† The numbers between brackets refer to the enumeration of the lessons learned in Table 1.

Figure 3-4. Clusters of lessons learned (boxes C1, C2, C3) and their relations (flag: analogy; arrow (A1, A2, A3): actions for researchers)

Cluster C1 addresses the researchers' role. The complex sustainability concept requires a diverse research team favoring knowledge creation. The MOTIFS case shows that success depends on shared process visions and objectives of all members of the team. Objectives should be safeguarded during the process by setting aside time for frequent reflection and decision-making, which is affirmed by Neef and Neubert (2011). Barriers in the MOTIFS case indicate that knowledge must be accumulated and promoted within the research team by motivating and documenting decisions. This should also help to tackle issues arising from changing team compositions. A team coordinator plays an important role in encouraging decision-making, evaluation and vision alignment within the team. We refer to these researchers' roles in the process as an institutional embeddedness enclosing an adaptive learning process.

Cluster C2 refers to the need for creation of ownership in the process. Farmers must recognize and accept their responsibility in achieving a more sustainable agricultural practice. A tool on its own cannot guarantee sustainable development in agriculture. Creating opportunities for active stakeholder involvement can stimulate this sense of ownership (Voinov and Bousquet, 2010; Prost *et al*., 2012). Various authors (van de Kerkhof, 2006; Bohunovksy and Jäger, 2008; De Kraker *et al*., 2009; Friend *et al*., 2009) have recognized the advantages of stakeholder involvement: i) increasing awareness and acceptance of perceived problems and measures required to solve problems, ii) better decision-making as it accounts for diversity in viewpoints, (local) knowledge and information on problems and solutions, iii) increasing support for the assessment outcomes, and iv) learning. The MOTIFS case study illustrates that organizing and managing good stakeholder involvement is a big challenge (see also Reed, 2008; Neef and Neubert, 2011). A well thought-out stakeholder selection for the different process stages, taking the intended end users into account, is critical (see also Weaver and Rotmans, 2006). Stakeholder involvement and creation of ownership require frequent communication between and evaluation with researchers and stakeholders. This also advocates facilitating knowledge interchange between stakeholders by the presence of competent facilitators (see also Reed, 2008; Cuéllar-Padilla and Calle-Collado, 2011).

Cluster C3 involves lessons with respect to tool functions. The MOTIFS process elicited a multiplicity of tool functions, such as monitoring, communication and decision support. These functions all require different specifications concerning implementation settings and end users (see also Bockstaller *et al*., 2009; Cerf *et al*., 2012; Prost *et al*., 2012). Even within one group of end users, needs can be different. For example, as their business evolves towards greater sustainability, farmers need tools with different functions. They first need a communication tool to raise their awareness, and only later require a

decision support or a monitoring tool. The MOTIFS case, revealed difficulties in combining all these functions into one tool, resulting in shortcomings when applying functions separately (see also de Ridder *et al*., 2007; Schader *et al*., 2012; Marchand *et al*., 2014). Therefore, it is important to maintain the link with the intended tool use during the development process (see also Cerf *et al*., 2012). Another tool characteristic shown in the MOTIFS case is the importance of the tool's implementation setting, for example, the use in discussion groups. The diversity of tool functions, end users and user settings underpins the importance of defining clear objectives for the tool (see also Reed, 2008).

By processing the data into lessons learned, we observed two types of relations between the aforementioned clusters. First, an analogy between C2 and C3 was detected and indicated as "richness in diversity" (Figure 4). Diversity concerns both stakeholder and end users (C2), e.g., farmers, farm advisors, government, or food processors, and tools (C3), emanating from different possible tool functions and/or the various intended end users. Several times, interviewees mentioned the importance of this richness in diversity. A second kind of relation is indicated as actions for researchers (A1 to A3 in Figure 4). In fact, the lessons learned necessitate three main challenges for researchers regarding the clusters ownership (A1) and tool functions (A3) and the link between them (A2).

The first type of action (A1) is "acknowledge mutual learning". Researchers and experts do not monopolize knowledge and can and should learn from stakeholders and end-users. We can underpin this action with Reed (2008), who advocates institutionalization of participation in organizational cultures. This supports tool design that fits the intended purpose and end users. Cerf *et al*. (2012) showed significant differences between designers' and users' interpretations of a problem and experienced so-called "debriefing sessions" between researchers and end-users as learning environments for researchers. They stressed the importance of involving end users early in the process. Berthet *et al*. (2012) denounced the lack of reflexivity in participatory design methods and highlight the need to develop reflexive frameworks to analyze and compare them. Grin *et al*. (2004) described this as reflexive design or "a process of judgment in which assumptions, knowledge claims, distinctions, roles and identities, normally taken for granted, must be critically scrutinized". Likewise, Langvad (2012) denoted the call for more case studies, seeking a deeper understanding of why processes unfold the way they do.

The second action type (A2) involves "coaching for appropriate tool use", to account for the diversity of stakeholders and tool functions. Several authors (Niemeijer and de Groot, 2008; Bockstaller *et al*., 2009; Gasparatos and Scolobig, 2012) mention the lack of guidelines or criteria on how to choose between tools in the sustainability assessment

literature. Future studies on how to link existing sustainability assessment tools to end users for a specific purpose are of paramount importance.

The third action type (A3) originates from the different possible tool functions. It entails structuring the development of different tool types and exploring spin offs from existing tools. For example, by using existing tools in different contexts, new tool concepts can be devised (Cerf *et al*., 2012). In this context, Marchand *et al*. (2014) proposed a complementary use of tools and the development of flexible tools for varying farming situations. However, the scientific basis for linking tools across disciplines and scales is still weak (Ewert *et al*., 2009).

Now, besides these revelations on lessons learned and actions to take, what is remarkable in this Chapter? We distinguish three main issues: what we investigated, the way we investigated it and the results it yielded. First, our approach to analyze the development and implementation process of MOTIFS to explain its lacking adoption for practical use is to our knowledge scarcely performed until now. Prost *et al*. (2012) argued that the agricultural research community is not concerned with the effects of the design methodology on the tools' suitability and potential applications. However, this Chapter shows that an evaluation of the development process can deliver valuable insights for future tool development. Second, the Blackstock *et al*. framework (2007) proved to be an appropriate method for such a process evaluation, although it is to our knowledge scarcely used. This framework helped to delineate the goals of our reflection process and the way to perform it. It helps to structure the abundance of information on MOTIFS. Further, the holistic approach recognizing the connection between context, research design and decision situation (see also Burgess and Chilvers, 2006) revealed the barriers and success factors within the development process. Third, our reflexive research resulted in lessons that could be verified by literature, but additionally revealed relations between these lessons, uncovering actions for researchers. These normative results make us eager to discuss similar or contradictory experiences with others.

3.5 Conclusion

A rigorous self- reflexive research on the MOTIFS development process enabled us to identify characteristics influencing its adoption by farmers and farm advisors. We did not only find various factors of failure and success that could be confirmed by similar findings in literature. We also realized a holistic picture arranging these elements as lessons learned. The basic structure of this arrangement consists of three clusters of lessons learned. A first cluster "institutional embeddedness" refers to the researchers' roles. Crucial is the presence of a diverse team with a clear guiding role of a coordinator. Further, the incorporation of

sufficient, well documented, reflection and decision moments must support the development process. A second cluster “ownership”, addresses the stakeholders’ roles and their responsibility. The latter can be strengthened through a well thought-out and active involvement of stakeholders and end users. This requires frequent communication and a suitable facilitation process. The third cluster “tool functions” reveals an extensive tool variety depending on the intended function and end users, calling for clear objectives during tool development and a well-considered (social) setting for tool use.

Our results show that reflection on tool development processes can deliver valuable insights for future tool development and implementation. Additionally, they evoke three types of actions for researchers and future research. Researchers should (i) learn from stakeholders and end-users, (ii) provide coaching for appropriate tool use, (iii) structure development of different tool types and explore spin-offs from existing tools. We hope our normative results evoke researchers to analyze their tool development processes and disseminate their knowledge, feeding a debate on this topic’s understanding. Furthermore, inspiration for future research can be found in our proposed actions for researchers, e.g., exploring the link between existing sustainability assessment tools, end users and purpose or examine the learning relation between researchers and stakeholders and end users.

3.6 How this Chapter set the scene.

The reflection on the MOTIFS development process resulted in some crucial insights that set the scene for the research performed in the following Chapters of this manuscript.

A first key insight was that a more systemic perspective should be taken into account for achieving sustainable development within Flemish agriculture. The reflection showed that sustainability assessment tools should be interpreted only as a tool in a broader learning process for sustainable development on farms. So, instead of merely focussing on tools, the wider learning context should also be taken into account. Indeed, the evolution from MOTIFS as a monitoring tool towards MOTIFS as a communication tool used in discussion groups suggests that tools can play a role in the transformational learning process required for sustainable development on farms as described in Chapter 1.3. The tools can have multiple functions in this process. They support farmers to interpret monitored data and thus to gain insight in their farming system. Specifically, the tools that include a diversity of social, economic and ecological sustainability themes and also take into account trade-offs between these themes, allow farmers to gain insight in the bigger picture and learn them to link different parts of their farming system. Further, the tools allow to show the impact of farm decisions on the farm’s environment. Additionally, by using and discussing those tools in groups, farmers also are confronted with other farmers’

perspectives and management strategies. These discussions challenge farmers to explain and justify why they perform specific farming practices the way they do, making them more conscious about their own farm management and decision making, and even can induce changes in their frame of reference.

A second key insight following from this reflection is that the learning on sustainable development and what in entails starts from the very beginning of an initiative, i.e. by discussing and negotiating on the object and approach of the initiative during the development of the initiative itself.

A third key insight followed from the use of the frameworks of Blackstock *et al*. (2007) and Burgess and Chilvers (2006). They show that, to understand the state of an initiative at a given point in time, it is important to take into account its developmental history, and the way it is influenced by the societal context and decisions made in early stage of the project. This suggests that the MOTIFS tool was loaded by its context and developmental history. For example, the type of researchers that were involved and the outcome expected from society, influenced the way sustainability was defined in the tool (i.e. represented in 10 sustainability themes and quantitatively measurable by the use of indicators).

These insights indicated the need to investigate initiatives for sustainable farming using a more systemic approach, by not only focussing on the tools used, but also on the broader learning context, and by not only taking into account the farmer learning, but also the organizational learning. This steered our choice to investigate the learning in SFIs that rather focus on a learning trajectory for farmers than on the development of tools that might be used in the learning process. In this way, it influenced the choice of our SFI cases that we will further investigate in this manuscript.

CHAPTER 4.

Exploring participation in a sustainable farming initiative with self-determination theory

This Chapter addresses R.Q. 2.1: *What is the motivation of participating farmers to participate in voluntary SFIs, and how is this motivation influenced by the participation context created by the SFI?* In this Chapter, we use the perspective of Self-determination theory to investigate why farmers participate in an SFI, what motivates them to join in the first place and how they are motivated to keep on participating. We thus try to explain the dynamics related to participation taking the individual farmers as an entry point.

This Chapter is based on following published paper:

> Triste, L., Vandenabeele, J., van Winsen, F., Debruyne, L., Lauwers, L., & Marchand, F. (2018) Exploring participation in a sustainable farming initiative with self-determination theory. International Journal of Agricultural Sustainability. Published online: 17/01/2018. https://doi.org/10.1080/14735903.2018.1424305

4.1 Introduction

Sustainable farming initiatives (SFI) attempt to support farmers in the sustainable development of the farm practices (Pretty and Bharucha, 2014; Runhaar *et al*., 2016). Indeed, current agricultural intensification, with increasing food production per hectare, has contributed to a negative impact on the environment and human health (Tittonell, 2014; Petersen and Snapp, 2015; Teschner *et al.*, 2017), which elicits responses from various fields. One such response is 'sustainable intensification' as a more environmentally-friendly alternative without using additional land nor incurring yield losses (Petersen and Snapp, 2015; Godfray, 2015; Pretty and Bharucha, 2014; Tittonell, 2014). However, sustainable

intensification does not prescribe one specific trajectory or technique to reach sustainability and includes a variety of approaches, e.g., conservation agriculture, integrated pest management or agro-ecology (Pretty and Bharucha, 2014). This means that practices of sustainable intensification are often context-specific.

The main challenge for an SFI is to attract farmers to participate and to continue participating. SFIs vary in their ability to attract farmers (Wilson and Hart, 2000), which calls for insight into the conditions that affect farmer participation (Runhaar *et al.*, 2016). Factors influencing farmer participation have been studied for different SFI types, but often refer to socio-demographic and contextual factors external to the SFI (Pavlis *et al.*, 2016). Farmer motivation for participation in SFIs, however, has received limited attention (Charatsari, Lioutas and Koutsouris, 2016) despite its recognised importance (Wilson, 1997; Smithers and Furman, 2003; Dedeurwaerdere *et al.*, 2016; Runhaar *et al.*, 2016). Motivation is often defined as the reasons why or the personal driving forces for participation. Research shows that motivational processes play a role in successful and long-lasting adoption of environmentally responsible practices (Osbaldiston and Sheldon, 2003; Dedeurwaerdere *et al.*, 2016) and in commitment to the SFI (Morris and Potter, 1995). Therefore, SFIs need a better understanding of how to stimulate particular types of motivational processes (Dedeurwaerdere *et al.*, 2016) to obtain information about how SFIs should be designed to attract farmers and keep them committed.

To provide theoretical grounds for linking motivation to a given participation context, we choose to apply the self-determination theory (SDT; Ryan and Deci, 2000b). SDT is well-established and relies on decades of theoretical and empirical research (Vansteenkiste, Niemiec and Soenens, 2010). SDT states that the perceived social context influences a person's motivation (Ryan and Deci, 1987; Osbaldiston and Sheldon, 2003; Lavergne *et al.*, 2010; Vansteenkiste, Niemiec and Soenens, 2010). This means that SFI characteristics not necessarily influence farmer motivation for participation; instead, it is the farmers' perception of the contextual setting created by the SFI that has the most influence. SDT can be useful to generate insights into the different types of farmers' motivational processes and how the farmers' perception of the participation context either contributes to or hinder the development of the types of motivational processes needed for sustainable farming behaviour. Until now, SDT in research on farmers and their participation in SFI has rarely been used (Charatsari, Lioutas and Koutsouris, 2016).

The objective of this paper is to explore the influence an SFI may have, through its design characteristics, on farmers' motives and underlying motivational processes to participate. Based on SDT, we developed a socio-psychological framework that links farmer participation to the SFI context, the participants' perception of that context and the

participants' motives and motivational processes. Using a mixed-method research approach, we explored these links in Veldleeuwerik, a Dutch SFI with about 400 farmers. Our aim is to formulate recommendations for SFI design and future research on farmer participation in SFIs.

We start with a literature review on farmer participation in SFIs and on SDT and discuss the development of our socio-psychological framework. We then elaborate on the case and the methods used to explore the links in our framework. After reporting our results, we formulate suggestions for further research and potential guidelines for SFI initiators.

4.2 Theoretical framework

4.2.1 Farmer participation in SFIs

In literature, much attention has gone to the willingness and decision to participate in various kinds of SFIs, such as sustainability standards (Luhmann, Schaper and Theuvsen, 2016), conservation programs (Greiner and Gregg, 2011), agricultural projects (Etwire *et al.*, 2013; Saxby, Gkartzios and Scott, 2017), agri-environmental schemes (AES) (Wilson and Hart, 2001; Damianos and Giannakopoulos, 2002; Defrancesco *et al.*, 2008; Lastra-Bravo *et al.*, 2015; Pavlis *et al.*, 2016), Environmental Farm Plan program (EFP) (Smithers and Furman, 2003; Atari *et al.*, 2009), and extension and education activities (Barbuto, Trout and Brown, 2004; Charatsari, Lioutas and Koutsouris, 2016; Charatsari *et al.*, 2017). In some SFIs, farmer participation is interpreted as the adoption of specific measures (e.g. sustainability standards, conservation programs, AES), while in others participation is seen as the involvement in a (joint) learning trajectory (e.g., EFP, extension and education activities such as Farmer Field Schools). Because of their voluntary nature, success of these SFIs depends on the farmers' willingness to participate and their continued commitment. This asks for a better understanding of the relation between the SFI design and the farmers' motivation, both to participate (Ruto and Garrod, 2009; Lastra-Bravo *et al.*, 2015; Charatsari, Lioutas and Koutsouris, 2016; Saxby, Gkartzios and Scott, 2017) and to improve environmental performance and responsibility (de Snoo *et al.*, 2013; Dedeurwaerdere *et al.*, 2016).

With this focus on farmer participation, socio-economic and demographic factors have been reported as influencing the decision to participate, such as characteristics related to the farms (e.g., location, production types, farm size) and the farmers (e.g., age, education, income, level of engagement in agriculture, successors, farming experience, knowledge about the SFI) (Wilson, 1997; Pavlis *et al.*, 2016). Interest has also been shown in the influence of socio-cultural, economic and policy contexts (e.g. access to credit and

agricultural extension services) (Etwire *et al.*, 2013; Price and Leviston, 2014). Organisers and designers of SFIs, however, have little influence on these characteristics. One research gap in participation research is the actual guidance for SFI design (Lastra-Bravo *et al.*, 2015).

Some participation research exists, but is dominated by studies on agri-environmental schemes (AES), Europe's main instrument to stimulate farmers to improve environmental conditions in rural areas (Pavlis *et al.*, 2016). These studies mainly focussed on the willingness to participate (or adopt practices) related to direct payments offered by AES (Home *et al*., 2014), and at the level of payment as a main driver for participation (Luhmann, Schaper and Theuvsen, 2016; Russi *et al.*, 2016). Recently, the effectiveness of direct payments is being questioned, and other approaches to influence the farmers' motivation and behaviour have been suggested (de Snoo *et al.*, 2013).

4.2.2 Need for a socio-psychological approach

The key role of farmer motivation in agricultural change and sustainable development is increasingly recognized (Price and Leviston, 2014). It is argued that drivers for participation other than the purely financial might be at play, and advocate for socio-psychological models in participation research in agriculture. This has been discussed for SFIs that provide direct payments (Wilson and Hart, 2000; Burton, 2004; Siebert, Toogood and Knierim, 2006; Greiner and Gregg, 2011; Home *et al.*, 2014) as well as those that do not (Smithers and Furman, 2003; Atari *et al.*, 2009; Charatsari, Lioutas and Koutsouris, 2016). Furthermore, a mere focus on financial motives does not explain why farmers participate in SFIs that do not offer financial compensation. This observation demands for a richer picture of farmers' motives for participation as a guide for SFI design.

Models from social psychology have therefore been introduced in participation research. Socio-psychological research relates farmers' decisions to participate to concepts, such as self-actualisation needs (Charatsari *et al.*, 2013), (self-) identity (Burton, 2004; Lokhorst *et al*., 2011; van Dijk *et al*., 2015; Wynne-Jones, 2017), personal norms (Lokhorst *et al.*, 2011), group norms and group identification (Home *et al*., 2014; van Dijk *et al*., 2015), psychological needs fulfilment (Charatsari, Lioutas and Koutsouris, 2016; Charatsari *et al*., 2017), and motivational orientation (Smithers and Furman, 2003; Barbuto, Trout and Brown, 2004; Greiner and Gregg, 2011; Charatsari, Lioutas and Koutsouris, 2016; Russi *et al*., 2016). Other scholars have performed research on farmers' motivation for pro-environmental behaviour (Beedell and Rehman, 2000; Price and Leviston, 2014; Mills *et al.*, 2016). For example, Price and Leviston (2014) found that an internal locus of control was the strongest single predictor of pro-environmental land management practice.

In addition, some research has been performed on how farmers are socio-psychologically influenced by participating in SFIs, such as through the SFI's ability to build social capital (de Krom, 2017), to create cultural capital (Burton and Paragahawewa, 2011), to increase wellbeing (Saxby, Gkartzios and Scott, 2017), or to meet socio-psychological needs (Charatsari *et al.*, 2017). These studies suggest that participation in SFIs can positively contribute to farmers' socio-psychological development, and moreover, that this can also positively influence the long-lasting adoption of sustainable farm practices (Saxby, Gkartzios and Scott, 2017). All these studies point to the complex processes underlying farmer participation in SFIs, and to the importance of including socio-psychological factors in the development of participation models.

4.2.3 Self- determination theory

It is therefore surprising that the self-determination theory (SDT), one of the most widely accepted motivation theories in a variety of research domains (Charatsari, Lioutas and Koutsouris, 2016), has not been used more frequently in agricultural research. SDT considers people as being active, growth-oriented and inclined towards the transformation of social norms and rules into personal values and self-regulation (Vansteenkiste, Niemiec and Soenens, 2010). People are seen as innately curious and interested, who "*possess a natural love of learning and desire to internalize knowledge, customs and values that surround them*" (Niemiec and Ryan, 2009). Interestingly, according to SDT, this transformation process can be supported or thwarted by contextual factors in the social environment (Deci and Ryan, 2000). This is an interesting proposition to explore the links between farmer motivation to participate in an SFI and the (farmer's perception of the) SFI participation context. To do so, SDT offers two interesting concepts: (i) the regulatory process of motivation ("why" are they motivated); and (ii) basic needs fulfilment ("how" is the motivational process being fed) (Deci and Ryan, 2000).

First, SDT recognizes different regulatory styles of motivation and posits that they differ in quality (Charatsari, Lioutas and Koutsouris, 2016). Like other theories, SDT distinguishes between intrinsic and extrinsic motivation (Wilson and Hart, 2000). For people who are intrinsically motivated, not the outcomes, but the enjoyment of the activity itself acts as an incentive (Barbuto and Scholl, 1998). In contrast, for people who are extrinsically motivated, not the activity, but the achievement of goals steered by external controls (e.g., a promised reward or social pressure) acts as incentive (Vansteenkiste, Niemiec and Soenens, 2010; Zepeda, Reznickova and Russell, 2013; Dedeurwaerdere *et al.*, 2016). Unlike other theories, SDT adds variation in the relative autonomy of extrinsic motivation (Ryan and Deci, 2000b). In SDT, different types of extrinsic motivation are discerned:

external regulation, introjected regulation, identified regulation, and integrated regulation. External and introjected regulation are categorized as controlled motivation and reflect compliance with external controls (Dedeurwaerdere *et al.*, 2016), such as peer pressure or rewards. Identified and integrated regulation, together with intrinsic motivation, are categorised as autonomous motivation and reflect personal endorsement and a feeling of choice (Dedeurwaerdere *et al.*, 2016).

When controlling factors are incorporated into the self, the result is autonomous motivation. This is called the internalisation process, defined as “an active, natural process in which individuals attempt to transform socially sanctioned mores or requests into personally endorsed values and self-regulations (Deci and Ryan, 2000, p. 235). For example, farmers may perceive participation in an SFI as being imposed by chain actors, but they can internalize participation into personally endorsed values and later perceive it as an autonomous choice.

The different motivation types discerned by SDT can thus be defined as being part of an internalization continuum. When externally regulated, no internalization occurs, and people are motivated to either obtain a reward or avoid punishment. For example, farmers participate in an SFI because they can obtain better product prices. In the case of introjected regulation, partial internalisation takes place and people are motivated to comply with the possibility to gain pride and self-esteem, to avoid feelings of guilt and shame, or address concerns about self- and other-approval. For example, farmers may participate in an SFI because they want to show their neighbours that they are a sustainable farmer. In the case of identified regulation, people are more self-determined, understand and endorse the personal value and significance of specific behaviour, experience the value of the behaviour as part of the self and have a feeling of psychological freedom. For example, farmers participate in an SFI because they believe sustainable development will contribute to the farm’s longevity. Finally, integrated regulation concurs with a full internalisation and involves the assimilation of identified values and goals and the alignment of those identifications with other aspects of the self. Integrated regulation does not become intrinsic motivation, but is still considered extrinsic motivation because the motivation is characterised not by the person being interested in the activity but rather by the activity being instrumentally important for personal goals (Gagné and Deci, 2005). For example, farmers participate in an SFI because sustainable behaviour is a part of their way of living.

Interestingly, SDT associates autonomous motivation with greater persistence, performance, social functioning, and physical and psychological well-being compared to controlled motivation (Vansteenkiste, Niemiec and Soenens, 2010). Moreover, autonomous motivation regarding environmental goals are a prerequisite for people to perform

environmentally responsible behaviour (Osbaldiston and Sheldon, 2003). In contrast, SDT also posits that controlling factors might influence autonomous motivation negatively, in such a way that controlling external events (e.g. threat of punishment, deadlines, evaluation, competition, and surveillance) can even undermine intrinsic motivation (Vansteenkiste, Niemiec and Soenens, 2010), eroding the feelings of joy, enthusiasm or interest that accompany the inherent human interest in learning and developing knowledge (Niemiec and Ryan, 2009). Even the introduction of external rewards might undermine intrinsic motivation (Deci, Cascio and Krusell, 1975). These controlling factors contribute to less cognitive flexibility, more shallow learning, less creativity and less positive emotional tone (Vansteenkiste, Niemiec and Soenens, 2010). However, by studying students' motivation during relatively uninteresting learning activities, Jang (2008) found that externally provided rationales can help students to generate the autonomous motivation needed to engage constructively and learn from uninteresting lessons. For SFIs, it thus seems important to create a context that fosters internalisation processes and autonomous motivation, or at least it should provide rationales to its participants for internalising behaviour. To define such fostering contextual conditions, we introduce the second SDT concept.

The second concept exists of three human psychological basic needs: autonomy, competence and relatedness (Ryan and Deci, 2002; Vansteenkiste, Niemiec and Soenens, 2010). Much research proves that these needs are innate, universal and, when satisfied, support optimal functioning and personal growth. Autonomy is the feeling of being in control of one's own behaviour and goals while experiencing volition and choice. The experience of autonomy facilitates internalization (Ryan and Deci, 2000a). It is crucial for the integration of regulations, for which people have to "*grasp its meaning and synthesise that meaning with respect to their other goals and values"* (Ryan and Deci, 2000a). Competence is the feeling of being effective in one's interactions with the social environment and experiencing opportunities to exercise and express one's capacities (Ryan and Deci, 2002). It is important because *"people are more likely to adopt activities that relevant social groups value when they feel efficacious with respect to those activities"* (Ryan and Deci, 2000b). Relatedness involves the feeling of belonging and feeling connected to other people and communities that are important to a person (Ryan and Deci, 2002). This is important, as the primary reason for people to engage in an extrinsically motivated behaviour is because they "*are prompted, modelled, or valued by significant others to whom they feel (or want to feel) attached or related"* (Ryan and Deci, 2000b). Therefore, for internalisation to occur, people need to feel like they are connected to others (Ryan and Deci, 2000b). According to SDT, the internalisation process requires satisfaction of all three basic needs (Ryan and Deci,

2000a), and intrinsic motivation requires the satisfaction of autonomy and competence needs (Niemiec and Ryan, 2009).

The social environment can support the three basic needs according to three dimensions (Vansteenkiste, Niemiec and Soenens, 2010). First, an autonomy-supportive, rather than controlling, context supports autonomy (Vansteenkiste, Niemiec and Soenens, 2010). Second, a well-structured, rather than chaotic and demeaning, context supports competence (Vansteenkiste, Niemiec and Soenens, 2010, p. 132) Third, a "warm and supportive", rather than "cold and neglectful", context supports relatedness (Vansteenkiste, Niemiec and Soenens, 2010, p. 132). The way the basic needs are satisfied is context specific, and may differ according to prevailing values and practices of cultural contexts (Chen *et al.*, 2015). Basic needs satisfaction might also be absent or even thwarted when people are exposed to a controlling, critical or rejecting context (Vansteenkiste and Ryan, 2013; Chen *et al.*, 2015). This is called basic need frustration and coincides with poor functioning and passivity (Vansteenkiste and Ryan, 2013). Translated to our study, to generate autonomous farmer motivation, SFIs should provide a context that supports basic needs and limits controlling factors, such as severe audits or overly strict rules.

4.2.4 Applying SDT to SFIs: a conceptual model

Based on our literature review, we come to two more specific research questions to reach the overall paper objective of exploring the influence of SFI design on the farmer's motivation to participate.

The first question is: what are farmers' motives and underlying motivational processes to participate in an SFI? Our literature review suggests that both farmers' motives to participate and the socio-psychological motivational processes can be informative to identify important SFI design characteristics. Motives are the reasons and personal goals that farmers identify regarding their choice to participate in an SFI. These do not necessarily concur with the SFI's major objective, i.e. to support farmers in the sustainable development of their farm, and thus can inform us about the requirements for SFI design. For example, Charatsari *et al*. (2017) found that farmers not only participated in Farmer Field Schools in the pursuit of knowledge, but also for the desire to feel part of a community. For the motivational processes, we refer to the SDT continuum, and SDT's proposition that autonomous motivational processes are related to more actual involvement, engagement and performance (Vansteenkiste, Niemiec and Soenens, 2010). Smithers and Furman (2003) found that farmers, who were more autonomously motivated regarding the environment and to participate in an Environmental Farm Plan program, participated more

fully in the programme and were more likely to implement or surpass their action plans than those who were motivated by economic stimuli or fear for regulation.

Our second research question is: how does the perception of the participation context influences farmers' motivational process to participate? Literature on both farmer participation and SDT shows that the perception of the context can influence the farmers' motivational processes. Because of its ability to support internalisation and intrinsic motivation, we argue that SFIs should provide a basic needs supporting context. Literature on SFIs also confirms the importance of these basic needs, mostly reported in terms of autonomy. Stock and Forney (2014) state that farmers highly value autonomy in their profession, and Charatsari *et al*. (2016) mention that cultivating an experience of autonomy within an SFI can increase farmers' intrinsic motivation. Burton and Paragahawewa (2011) found that it is essential for AES to leave the responsibility for developing management solutions for specific problems with the farmers. Others stress the importance of farmer groups in SFIs, because satisfactory social learning processes amongst farmers are suggested as good tools to change social norms such as regarding sustainable farming (de Snoo *et al*., 2013; Mills *et al*., 2016; Saxby, Gkartzios and Scott, 2017). To investigate the perception of the participation context, we are interested in both the perceived fulfilment of the psychological basic needs and in specific SFI characteristics related to the perception of the context (e.g. participation rules, which might influence the feeling of autonomy).

We link concepts of both research questions in a conceptual model of farmer participation in SFIs (Figure 4-1). Specific characteristics of the participation context influence the participants' perceptions of this context, which in turn influences participants' motivational processes. Specific context characteristics also influence participants' motives, as farmers might participate for specific purposes (e.g. knowledge exchange, social contact) that they believe can be met by the SFI context characteristics.

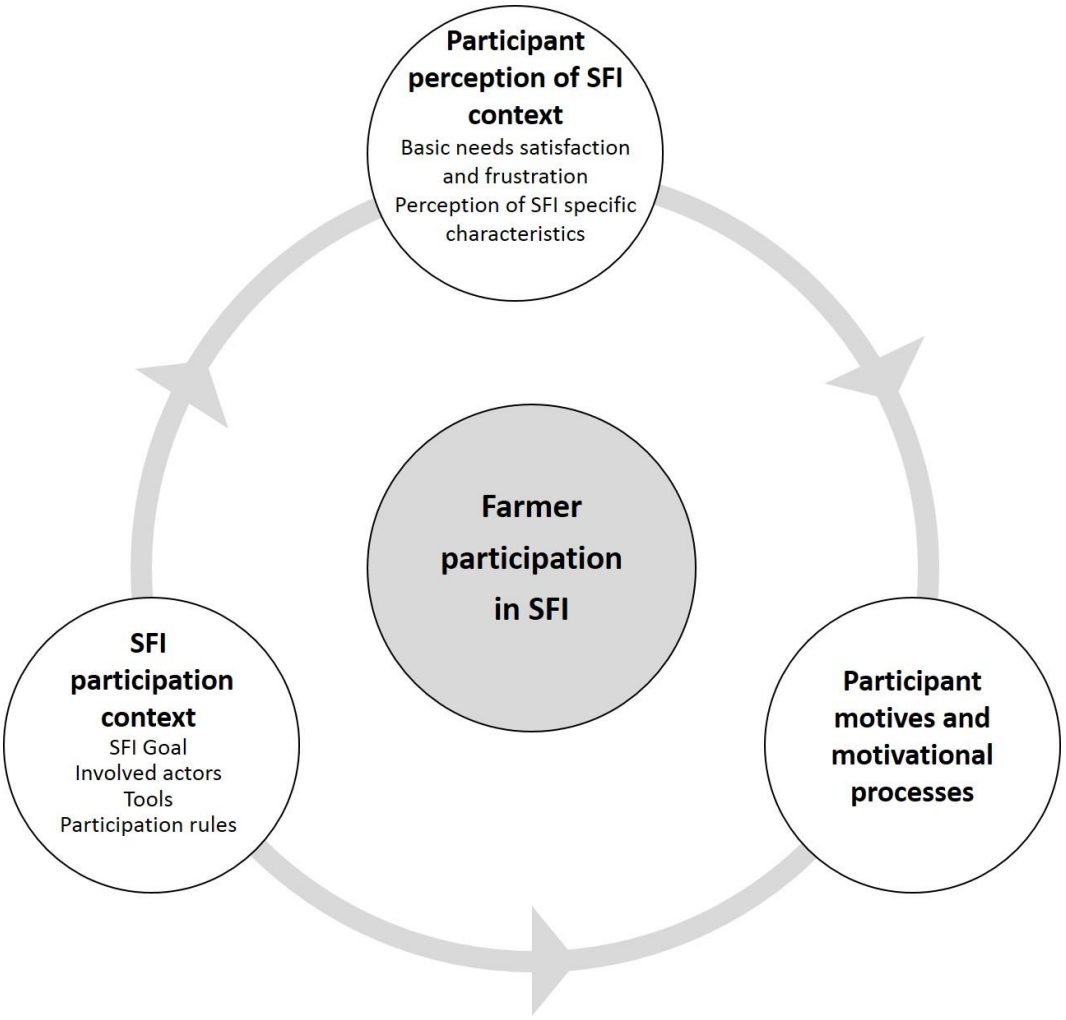


Figure 4-1. Conceptual model on farmer participation in SFIs

4.3 Methods

4.3.1 Case: Veldleeuwerik

Initiatives that merely focus on giving farmers compensation to adopt a specific practice are increasingly pictured as an unsustainable approach to change farmers' behaviour. Therefore, scholars advocate for other approaches to spur pro-environmental behaviour (de Snoo *et al.*, 2013), such as the inclusion of social learning processes (Price and Leviston, 2014; Mills *et al.*, 2016). In this study, we focus on an SFI that aims to engage farmers in a learning process, without coupling direct financial benefits to participation.

Veldleeuwerik (VL; "Skylark Foundation" in English) is a Dutch initiative for arable supply chains initiated in 2002 by several food processors and 10 arable farmers. The aim is to establish on-farm sustainable development and to facilitate the development of sustainable arable food chains through a knowledge exchange network. Farmers have to pay to participate in VL according to their firm size. At the time of this writing, approximately

400 farmers, 25 chain partners and 15 advisory firms were involved. VL can be called a success because of its longevity and relatively high farmer participation rate.

To encourage on-farm sustainable development, multiple activities are organised with various degrees of farmer involvement. First, at farm level, participating farmers develop a sustainability plan with a set of 10 sustainability themes for on-farm sustainable intensification, assisted by an accredited farm advisor. These themes are product value, soil fertility, soil loss, nutrients, crop protection, water, energy, biodiversity, human capital, and local economy. The farmer must revise the plan every year and formulate new sustainability actions. Second, at regional level, each farmer is a member of a fixed regional knowledge exchange group of approximately 10 farmers, facilitated by a regional coordinator. Third, at supra-regional level, several knowledge workshops are organised by supply chain partners; typical attendance is 20 to 40 farmers.

To guarantee the quality of its design, VL developed a system with specific rules for participation: e.g. participation in a minimum of 8 farmer group meetings per year and annual renewal of the sustainability plan. Since 2015, farmers obtain a VL sustainability certificate when they comply with these rules.

4.3.2 Procedure

Given the scarce use of SDT in SFI contexts, we chose for an exploratory research design to answer our research questions. We used a mixed-method approach, i.e. a combination of qualitative and quantitative research (Teddlie and Tashakkori, 2009). Such an approach is gaining increased popularity in agricultural and rural studies focusing on personal, social and psychological variables (Wauters and Mathijs, 2012). We used two ways to acquire data.

The first, more qualitative way combines three sources on farmers' motives to participate in VL: (i) interviews with 6 VL farmers (in 2013 and 2014); (ii) researcher's field notes taken during newly-started regional farmer group meetings (in 2014 and 2015); (iii) reports of the first meetings of other regional farmer groups provided by a regional coordinator of VL (in 2012 and 2013). These data were used to gain insights in farmers' motives to participate in VL, and were qualitatively coded using the Grounded Theory approach (Strauss and Corbin, 1998). Four motive categories emerged: (i) sustainability, (ii) social contact with colleagues, (iii) knowledge exchange, and (iv) business opportunities.

The second source is a mixed-method survey, comprising both open- ended and closed- ended questions (Teddlie and Tashakkori, 2009), distributed to all VL farmers (n = 392) via email in December 2015. The survey included 5 main parts. First, general

information was asked about topics like duration of participation, intention to continue participation next year. The second part concerned their motives to participate, comprising both open-ended qualitative questions and Likert-type quantitative questions on farmers' motives and motivational processes. The Likert-type questions were based on the motive categories that emerged from our first data sources and on 5 SDT types of motivational processes. The third and fourth part contained questions about their perception of the participation context, using the concept of basic needs and SFI specific characteristics. The last part gathered information about the respondent's characteristics. In January 2016, we retrieved answers from 96 respondents, 74 of which completed the entire survey. This rather low response rate of 19% might have been caused by the length of the survey and VL's reluctance to send reminders to the farmers to protect them from excessive questioning (other researchers and firms are also eager to question the VL farmers). To maximise our data set, we decided to also include the incomplete surveys using pair-wise deletion. This means that in our results section, the number of respondents ranges between 74 and 96. The respondents' average age (n= 70) was 49.1 years (SD: 10.6; range 27-75), their mean farm size (n=61) was 121 ha (SD: 110; range 25-600), and for 21 respondents (n = 72; 29%) succession was not assured. On average, they (n = 97) had been participating in VL for 3.9 years (SD: 2.3; range 1-13) and 42 respondents (n=67, 62%) were members of other study groups. The large majority (84%) of the respondents claimed they would continue to participate next year, while 16% was not sure about it yet.

To answer our first research question on farmers' motives and motivational processes to participate, we used the qualitative data from the interviews, field notes, reports and survey as well as quantitative data from the survey addressing farmers' motives and motivational processes. For answering the second research question on the relation between the perception of the participation context and the farmers' motivational process, we used the quantitative data from the survey.

4.3.2.1 Farmers' reported degree of importance to motive categories

Quantitative data about the farmers' motives were obtained by asking the respondents to rank the 4 motive categories (see above) according to the importance they attributed to them for participating in VL (Table 4-1).

Table 4-1. Respondents' ranking in order of importance of the motive categories for participating in VL.

	First place (n=62)	Second place (n=61)	Third place (n=61)	Fourth place (n=61)
Sustainability	8	21	19	13
Knowledge exchange	42	14	3	3
Social contact	2	4	19	35
Business opportunities	10	22	19	9

4.3.2.2 Motivational process

To obtain quantifiable data on farmers' motives and motivational processes to participate, we constructed items representing the 5 types of motivational regulation (external, introjected, identified, integrated and intrinsic motivations) for each motive category (sustainability, social contact, knowledge exchange and business). For constructing the items, we were inspired by previously built and tested self-regulation surveys (e.g. the Motivation at Work Scale of Gagné *et al*. (2010); the revised sports motivation scale of Pelletier *et al*. (2013); the motivation toward the environment scale of Pelletier *et al*. 1998; the perceived locus of causality and internalisation scale for acting of Ryan and Connell (1989)), and the input from our qualitative data sources. The construction of the items was discussed with 3 researchers. At least one item for each motivation type per motivation content category was formulated. For each item, respondents indicated how much they agreed with an assertion (1= totally disagree, 7= totally agree).

Guided by SDT, and similar to Lavergne *et al*. (2010), we aggregated the different regulatory styles of motivation in 2 main constructs for motivational processes, i.e. controlled motivation (external and introjected) and autonomous motivation (identified, integrated and intrinsic motivation). Autonomous motivation processes reflect personal endorsement and feeling of choice (Dedeurwaerdere *et al.*, 2016). Controlled motivation processes reflect compliance with external or self-imposed controls (Lavergne *et al.*, 2010). Table 4-2 shows which items were used to calculate means for these constructs. Cronbach's alpha scores were calculated to measure the internal consistency of the constructs. Cronbach's alpha scores (Table 4-2) were deemed adequate (>.60; Robinson *et al*., 1991; Hair *et al*., 2006) for 5 of the 8 constructs. For the constructs autonomous motivation for business opportunity (α = .36), controlled motivation for sustainability (α = .34) and controlled motivation for social contact (α = .49) alpha scores were too low. This was taken into account during subsequent analyses.

Table 4-2. Items, mean scores, standard deviations and Cronbach's alpha for constructs measuring the motivational processes.

Construct	Items: starting with "*I joined VL because … "*	Mean	SD	n	A
Sustainability					
Autonomous motivation		*5.29*	*1.01*	*91*	*0.76*
Intrinsic regulation	It gives me a good feeling to sustainably develop my farm.	4.99	1.37	91	
Integrated regulation	I'm also engaged in sustainability in daily life.	5.29	1.18	91	
Identified regulation	I am aware of the importance of sustainable farming.	5.58	1.12	91	
Controlled Motivation		*3.48*	*1.36*	*91*	*0.34*
Introjected regulation	My social environment finds it important that my farm becomes sustainable.	3.44	1.78	91	
External regulation	I want to acquire a sustainability certificate.	3.53	1.73	91	
Knowledge exchange					
Autonomous motivation		*5.49*	*0.94*	*88*	*0.76*
Intrinsic regulation	I enjoy learning.	5.39	1.17	88	
Integrated regulation	Continuous learning is something that I have been doing all my life.	5.57	1.72	88	
Identified regulation	I acknowledge the importance of gaining new knowledge and ideas.	5.51	1.10	88	
Controlled Motivation		*2.47*	*1.25*	*88*	*0.63*
Introjected regulation	My social environment thinks that I need to gain new knowledge.	2.39	1.45	88	
External regulation	I'm not interested in knowledge exchange, but joined VL for other reasons.	2.55	1.47	88	
Social contact					
Autonomous motivation		*4.74*	*1.14*	*87*	*0.78*
Intrinsic regulation	I enjoy meeting and visiting other farmers.	4.95	1.33	87	
Integrated regulation	I have always sought contact with fellow farmers.	4.23	1.50	87	
Identified regulation	I think it is important that farmers meet each other.	5.05	1.28	87	
Controlled Motivation		3.35	1.13	87	0.49
Introjected regulation	Acquaintances advised me to meet fellow farmers.	2.15	1.36	87	
External regulation	I believe the social contacts will provide benefits.	4.55	1.41	87	
Business opportunities					
Autonomous motivation		*5.19*	*0.86*	*84*	*0.36*
Intrinsic regulation	I enjoy discussing farming business with fellow farmers.	5.11	1.12	84	
Integrated regulation	I always wanted to be a good farmer.	4.93	4.63	84	
Identified regulation	I think it is important to critically look at my own farm and to continuously improve.	5.54	1.10	84	
Controlled Motivation		*3.20*	*0.97*	*84*	*0.65*
Introjected regulation	The consumer wants me to.	2.57	1.39	84	0.48
	I joined VL because I want to have pride in my farm.	4.10	1.72	84	
	My buyer is directing me to.	2.13	1.39	84	
External regulation	I hope it will help to make policy more flexible for farmers.	3.48	1.70	84	0.72
	I'm interested in the market opportunities	3.24	1.62	84	
	I hope for higher product prices	4.13	1.73	84	
	I'm interested in the benefits of the greening measures (CAP).	3.01	1.52	84	

4.3.2.3 Basic needs perception

In our survey, we tested the respondents' basic needs frustration or satisfaction during the latest year's activities of VL. Nineteen Likert-type items (7-point Likert scale) were adjusted from the 'Basic psychological needs and frustration scale' developed by Chen *et al*. (2015) to the context of VL. Originally, this scale contains 24 items. However, after translation to the VL context, 5 items resembled another item. Because of possible trade-offs between the questions and the number of participants, these items were removed (Table 4-3).

Means were calculated for all items regarding autonomy frustration (3 items) and satisfaction (3 items), competence frustration (3 items) and satisfaction (3 items), relatedness frustration (3 items) and satisfaction (4 items), respectively. Chronbach's Alpha scores were satisfactory ($\alpha > 0.60$) for all basic needs perceptions, except for relatedness frustration ($\alpha = .39$). As in Chen *et al*. (2015), this construct was kept in subsequent analyses, regardless of the low Cronbach's alpha score, to enable examination of the distinct role of all 3 needs. Extra care was taken when interpreting the particular results.

4.3.2.4 Perception of SFI specific context characteristics

Perception of the participation rules (Table 4-4). The respondents' perceptions of the participation rules were questioned because we assume that they can have both a controlling and a structuring effect, which might influence autonomy and competence support. Respondents were asked to pick one of the following options about participation rules: (i) They are a heavy burden; (ii) I find it hard to meet them, but I'm trying my best; (iii) I find them annoying, but I accept them; (iv) I find them annoying, but I understand why they are necessary; (v) I don't think they are burden at all; (vi) I think they should be more strict. To enable the calculation of correlations with other constructs, these answers were scored from 1 to 5, with '1' reflecting the least degree of acceptation of the rules and '5' total agreement with the rules. Answers (ii) and (iii) were given an equal score of 2.

Perception of knowledge exchange (Table 4-4). Participant perceptions of knowledge exchange within VL was measured, as this is VL's main tool to achieve on-farm sustainable development. Respondents were asked about the value they attributed to knowledge exchange within the farmer groups, with chain partners, with the VL organisation, and during the drafting of the sustainability plan. These items were rated on a scale from 1 (very bad) to 7 (very good).

Perception of support to achieve personal goals (Table 4-4). Farmers were asked to rate on a scale from 1 to 7 how well they agreed with the following assertion: "*During the*

VL activities I have the feeling that I received sufficient information and support to achieve my personal goals".

Table 4-3. Items, mean scores, standard deviations and Cronbach's alpha for constructs measuring basic needs perception.

Construct	Item (preceded by 'During last year's VL activities …')	Mean	SD	n	α
Autonomy – satisfaction		5.00	0.93	75	0.71
	I had a feeling of choice and freedom in the things I did.	5.30	1.03	76	
	I have the feeling that what VL expected from me as a participant concurred with what I wanted myself	4.46	1.31	76	
	What we do truly interests me.	5.21	1.15	75	
Autonomy – frustration		2.51	0.94	75	0.68
	I felt forced to do things I would not choose for myself	2.59	1.25	76	
	I often felt obliged to make a lot of effort.	2.36	1.13	76	
	Most tasks feel as an obligation.	2.63	1.27	75	
Relatedness – satisfaction		4.59	0.78	75	0.60
	I feel appreciated as a full member.	5.41	1.01	76	
	I felt closely related to other people who are important to me.	3.53	1.15	76	
	I experience that participants who are important to me also give importance to me.	4.09	1.40	76	
	I have a positive feeling about the time I spend with other participants.	5.28	1.09	75	
Relatedness – frustration		2.66	0.81	75	0.39
	I didn't feel welcome.	1.47	0.92	76	
	I experience only superficial relationships with other participants.	4.03	1.36	75	
	I had the feeling that participants who are important to me act distant towards me.	2.47	1.29	75	
Competence - satisfaction		5.36	0.80	75	0.66
	I have confidence in the fact that I meet the expectations.	5.43	1.10	76	
	I feel competent to reach my goals.	5.35	1.01	75	
	I felt competent about what I did.	5.29	0.98	75	
Competence – frustration		2.52	0.98	75	0.61
	I felt unsure about my competencies.	2.39	1.21	76	
	I felt disappointed about the progress I made.	3.00	1.62	75	
	I have the feeling that the competence level is too high for me.	3.04	1.12	75	

Table 4-4. Mean, standard deviations and number of respondents for the SFI specific context characteristics.

Construct- Item	Mean	SD	n
Perceived knowledge exchange.			
between farmers and chain partners	3.43	1.38	81
between farmers and the VL organisation	4.31	1.14	81
within the regional farmer groups	5.78	1.11	81
during drafting the sustainability plan	4.72	1.33	81
Perception of the participation rules	3.13	0.96	80
Perception of support to achieve personal goals	4.85	1.24	75

4.4 Results

4.4.1 Farmer motives and motivational processes to participate in VL.

Based on the interviews, reports, field notes and open ended survey questions, 4 main farmer motive categories to participate in VL emerged. The motives relate to sustainability, knowledge exchange, social contact and business opportunities (Table 4-5). However, the motives are not exclusive to one category; for instance, some respondents reported motives that fit both the knowledge exchange and sustainability categories. Important are also the motives in the category "other", which reflect motives specifically related to the VL approach, e.g. its bottom-up approach, the discussion group approach, the focus on soil health or the whole-farm approach with 10 sustainability indicators. This is also reflected in the answers to the survey question about why respondents wanted to continue participating in VL for another year (Table 4-6). Some motives clearly reflect the value attributed to some of the participation context characteristics created by VL, e.g. the knowledge exchange in farmer groups, the ability to obtain a sustainability label or benefits for meeting the CAP greening measures. Our analysis reveals that a majority of farmer motives to continue participating could be attributed to knowledge exchange, and to a lesser extent to sustainability, social contact and business opportunities. The respondents' ranking of motive categories confirms the attributed importance for participating in VL (Table 4-1): knowledge exchange is attributed as most important (ranked at first or second place) by 56 respondents (90%), followed by business, sustainability and social contact with respectively 32 (48%), 29 (52%) and 6 (10%) rankings in first or second place.

The qualitative analysis of the 4 motive categories reflects a variety of underlying motivational processes. For example, in the category 'sustainability' we discern both rather controlled motivational processes, such as obtaining a sustainability certificate or because sustainability is a hot topic in the sector as well as more autonomous motivational processes, such as the farmers' interest in sustainability or the acknowledgement of the importance of sustainability. Paired sample t-tests, comparing the questioned autonomous vs. controlled motivation processes, indicate that the respondents showed a significantly higher rate of autonomous than controlled motivation. Significant differences were found for all comparisons of motive categories (Table 4-2): autonomous vs. controlled motivation for sustainability, $t(90) = 13.75$ ($p << 0.01$); autonomous vs. controlled motivation for knowledge exchange, $t(87) = 18.37$ ($p << 0.01$); autonomous vs. controlled motivation for social contact, $t(86) = 10.98$ ($p << 0.01$); autonomous vs. controlled motivation for business opportunities vs. controlled motivation for knowledge exchange, $t(83) = 17.00$ ($p << 0.01$).

This analysis of farmer motives to start participating and to keep on participating in VL shows that: (i) respondents had multiple reasons to participate (reflected in the motive categories); (ii) respondents were motivated by a range of underlying regulatory processes; (iii) context characteristics played an important role in the decision for further participation.

Table 4-5. Farmers' initial motives to start participating in VL per motive category and the number of respondents claiming this motive.

Motives	#	Motives	#
Sustainability	55	**Business opportunities**	49
To learn how to farm in a sustainable way	17	*On-farm development*	20
Because I want to produce in a sustainable way	13	To bring my farm to a higher level	11
Because I acknowledge the importance of sustainability	6	To achieve ideas for the future	3
		To be up to date with my farm	2
As a proof that we work sustainably	5	To be ahead vs. other farmers	1
Because I am interested in sustainability	3	To enjoy the benefits for meeting the CAP greening measures	1
To be able to farm in the future	3		
Because I am curious about sustainability in arable farming	2	To farm in a good way	1
		To increase my product quality	1
To farm consciously	2		
Because I already work intensively on sustainability	1	*Sales opportunities*	28
		To obtain better product prices	11
Because I want to contribute to sustainable agriculture	1	Because my buyer prefers membership	6
		Because it is a marketing tool towards consumers	4
To obtain a sustainability certificate	1	Because it is a license to produce	2
Because sustainability is a hot topic in the sector	1	To increase my selling market	2
Social contact	12	I'm interested in the financial benefits it can generate	1
Be part of a study group	3	For the opportunity to create new business relations	1
Talk with colleagues	3		
To visit other farms	3	To anticipate future demands of buyers	1
To compare my farm with other farms	1		
Working together with the whole chain	1	*To reveal workability of the agricultural policy*	1
Other	35	**Knowledge exchange**	34
Because of the VL approach	28	*Knowledge acquisition*	21
Because I have heard and read a lot about VL	1	For inspiration and new ideas	3
They asked me to join	2	To increase my expert knowledge	2
Because I wanted to extend the existence of an existing study group	2	To learn about the soil	2
		To keep up with developments	1
To be part of the club	1	To quickly increase my knowledge level	1
Because I wanted a study group in our province	1		
		Knowledge exchange with colleagues	13
		To be part of a study group	4
		To be actively involved in knowledge on arable farming	1

Table 4-6. Farmers' motives to keep on participating in VL per motive category and the number of respondents claiming this motive.

Motives	#	Motives	#
Sustainability	17	**Business opportunities**	11
To continue to develop sustainably	8	Because of the benefits to meet the CAP greening measures	3
It is important to produce sustainably	4	It creates added value at farm level	2
To help create awareness about the sustainability of my farming practices	3	To show as a sector that we make good progress	2
I'm interested in a sustainability label	1	Buyers appreciate my participation in VL	1
Because of the knowledge exchange regarding sustainability	1	Because I can obtain a low interest rate at a specific bank	1
Because of the stewardship of the environment	1	The regional group makes me reflect on possible future steps	1
VL answers the need for information on sustainability	1	There are still many challenges at my farm	1
Social contact	13	**Knowledge exchange**	52
We have a nice group	8	It is educational	10
It's cosy	2	To exchange knowledge and experiences with fellow farmers	9
It is nice to meet other farmers	1	It provides knowledge	9
Because we have to work together to achieve something	1	To learn from other farmers	7
The social contact with fellow farmers is important	1	Participation creates awareness	4
		It is interesting	4
Other	19	To critically reflect my own practices and motivation	3
I believe in the VL approach	11	To deepen our understandings and broaden our insights	3
I like it	3	I like the knowledge level	1
I can see the benefits	1	It is inspiring	1
I see its added value	1	It provides hands on information	1
I want to stay on the chosen track	1		

4.4.2 Influence of perceived participation context on farmer motivation to participate

To explore how the participation context influenced farmer motivation, Pearson correlations were calculated for the respondents' reported autonomous and controlled motivation processes, basic needs satisfaction and frustration and perception of particular context specific characteristics (Table 4-7).

As expected, we found that basic need satisfaction and frustration are negatively correlated to each other: all 9 combinations of a basic need satisfaction with a basic need frustration have a negative correlation coefficient, 8 of which are significant (Table 4-7). At the same time, all of the 3 possible combinations of basic need satisfaction and the three possible combinations of basic need frustration among themselves show positive and significant correlation coefficients (Table 4-7). Paired sample t-tests between satisfaction and frustration scores for each of the basic needs (Table 4-3) show that satisfaction scores

are significantly higher than frustration scores: for autonomy, t (74)= 13.38 (p<<0.01); for relatedness, t(74)= 12.78 (p<<0.01); for competence, t(74) = 16.19 (p<<0.01).

Further, our results revealed positive correlations between the specific context characteristics and the basic needs satisfaction (Table 4-7). The respondents' autonomy satisfaction is positively correlated with all specific context characteristics (Knowledge exchange in regional groups: 0.39, p<0.01; Knowledge exchange with the chain partners: 0.27, p= 0.02; Knowledge exchange with VL organisation: 0.44, p<0.01; Knowledge exchange during drafting of the sustainability plan: 0.37, p<0.01; perception of the participation rules: 0.28, p= 0.02; and perceived support for personal goal achievement: 0.38, p<0.01) (Table 4-7). Relatedness satisfaction is only positively correlated with the respondents' perception of the knowledge exchange within the regional group (0.32, p= 0.01), with the chain partners (0.26, p = 0.02) and with the organisation (0.44, p<0.01), and with the perceived support for achieving personal goals (0.41, p<0.01) (Table 4-7). Competence satisfaction is only positively correlated with the knowledge exchange within the regional group (0.44, p<0.01) and with the perceived support to achieve personal goals (0.31, p= 0.01) (Table 4-7). Furthermore, we found that the perception of the participation rules is positively correlated with autonomy satisfaction (0.28, p= 0.02) and negatively correlated with autonomy frustration (-0.33, p<0.01) (Table 4-7).

As expected from theory, our results show significant positive correlations between all the basic needs satisfaction scores and the autonomous motivation scores. Some positive correlations are found between basic needs satisfaction and controlled motivation scores, but this pattern is less clear: between autonomy satisfaction and controlled motivation for knowledge exchange (0.33, p<0.01), and between relatedness satisfaction and controlled motivation for sustainability (0.35, p<0.01), for knowledge exchange (0.23, p = 0.04), and for business opportunities (0.31, p = 0.01) (Table 4-7).

Table 4-7. Correlation between motivation types, basic needs satisfaction and frustration and perception of context specific characteristics

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Motivational process																			
1. Autonomous - Sustainability	/																		
2. Autonomous - Knowledge exchange *(n=88)*	0.30**	/																	
3. Autonomous - Social contact *(n= 87)*	0.18	0.56**	/																
4. Autonomous - Business opportunities *(n=84)*	0.46**	0.54**	0.55**	/															
5. Controlled - Sustainability	0.48** *(n=91)*	0.28** *(n=88)*	0.35** *(n=87)*	0.38** *(n=84)*	/														
6. Controlled -Knowledge exchange	0.15 *(n=88)*	0.02 *(n=88)*	0.18 *(n=87)*	0.18 *(n=84)*	0.41** *(n=88)*	/													
7. Controlled - Social contact	0.15 *(n=87)*	0.37** *(n=87)*	0.46** *(n=87)*	0.36** *(n=84)*	0.36** *(n=87)*	0.39** *(n=87)*	/												
8. Controlled - Business opportunities *(n=84)*	0.16	0.13	0.32**	0.37**	0.48**	0.54**	0.52**	/											
Basic Needs perception																			
9. Autonomy satisfaction *(n=75)*	0.47**	0.28*	0.34**	0.48**	0.22	0.33**	0.06	0.20	/										
10. Relatedness satisfaction *(n=75)*	0.32**	0.28*	0.29*	0.39**	0.35**	0.23*	0.08	0.31**	0.54**	/									
11. Competence satisfaction *(n=75)*	0.28*	0.27*	0.25*	0.41**	0.18	0.19	0.05	0.20	0.54**	0.45**	/								
12. Autonomy frustration *(n=75)*	-0.22	-0.18	-0.06	-0.17	0.02	-0.01	0.20	0.29*	-0.47**	-0.19	-0.38**	/							
13. Relatedness frustration *(n=75)*	-0.01	-0.11	-0.15	0.07	-0.11	-0.02	0.18	0.05	-0.24*	-0.35**	-0.05	0.29**	/						
14. Competence frustration *(n=75)*	-0.17	-0.20	-0.06	-0.15	-0.07	-0.02	0.07	0.04	-0.41**	-0.30**	-0.45**	0.44**	0.33**	/					
Perceived context characteristics																			
15. Knowledge exchange - Regional group	0.11 *(n=81)*	0.20 *(n=81)*	0.31** *(n=81)*	0.28* *(n=81)*	0.04 *(n=81)*	0.15 *(n=81)*	0.15 *(n=81)*	0.03 *(n=81)*	0.39** *(n=75)*	0.32** *(n=75)*	0.44** *(n=75)*	-0.14 *(n=75)*	-0.08 *(n=75)*	-0.22 *(n=75)*	/				
16. Knowledge exchange- With chain partners	0.08 *(n=81)*	0.20 *(n=81)*	0.20 *(n=81)*	0.12 *(n=81)*	0.21 *(n=81)*	0.11 *(n=81)*	0.29** *(n=81)*	0.14 *(n=81)*	0.27* *(n=75)*	0.26* *(n=75)*	0.07 *(n=75)*	-0.05 *(n=75)*	-0.23* *(n=75)*	-0.20 *(n=75)*	0.35** *(n=81)*	/			
17. Knowledge exchange - with VL organisation	0.41** *(n=81)*	0.39** *(n=81)*	0.40** *(n=81)*	0.29** *(n=81)*	0.36** *(n=81)*	0.20 *(n=81)*	0.31** *(n=81)*	0.11 *(n=81)*	0.44** *(n=75)*	0.37** *(n=75)*	0.19 *(n=75)*	-0.17 *(n=75)*	-0.09 *(n=75)*	-0.29* *(n=75)*	0.36** *(n=81)*	0.53** *(n=81)*	/		
18. Knowledge exchange -Sustainability plan	0.03 *(n=81)*	0.23* *(n=81)*	0.08 *(n=81)*	0.20 *(n=81)*	0.12 *(n=81)*	0.30** *(n=81)*	0.26* *(n=81)*	0.14 *(n=81)*	0.37** *(n=75)*	0.18 *(n=75)*	0.16 *(n=75)*	-0.19 *(n=75)*	-0.07 *(n=75)*	-0.15 *(n=75)*	0.08 *(n=81)*	0.17 *(n=81)*	0.37** *(n=81)*	/	
19. Participation rules	0.19 *(n=80)*	0.24* *(n=80)*	0.16 *(n=80)*	0.17 *(n=80)*	0.07 *(n=80)*	0.02 *(n=80)*	-0,00 *(n=80)*	-0.01 *(n=80)*	0.28* *(n=75)*	-0.03 *(n=75)*	-0.01 *(n=75)*	-0.33** *(n=75)*	-0.14 *(n=75)*	-0.05 *(n=75)*	-0.01 *(n=80)*	0.08 *(n=80)*	0.14 *(n=80)*	0.27* *(n=80)*	/
20. Perceived support for personal goal achievement *(n=75)*	0.20	0.33**	0.25*	0.35**	0.11	0.19	0.05	0.13	0.38**	0.41**	0.31**	-0.15	-0.05	-0.14	0.30**	0.09	0.30**	0.21	0.12

4.5 Discussion

The aim of the study was to explore farmers' motives and underlying motivational processes to participate in an SFI ('*Veldleeuwerik'*). Our research revealed that the farmers' motives can be diverse, manifold, and directed by a diversity of underlying motivational processes. Further, our research indicated that specific design characteristics of the SFI participation context influence farmers' motives and underlying motivational processes to participate. Substantiated with literature on farmer participation and SDT, we discuss the implications of our research for practice and future research, in particular SFI design characteristics that are needed to both attract farmers to participate and to obtain persistent farmer participation. Those characteristics are not necessarily the same and might even seem contradictory at first sight. After discussing implications, we reflect on some limitations of our research.

4.5.1 SFI characteristics to stimulate non-participating farmers to participate

In an SFI context, it would seem logical that participating farmers' motives are related to sustainability, but our research showed at least 4 categories of motives to participate in VL: sustainability, knowledge exchange, social contact and business opportunities. The reported motives also revealed a variety in underlying motivational processes reflecting SDT's motivation continuum. This multiplicity of motives and motivational processes for participation in SFIs confirms other research (e.g., Wilson and Hart, 2000; Lokhorst *et al*., 2011; Russi *et al*., 2016). These findings are interesting to define SFI characteristics aimed at stimulating farmers whose motivational processes regarding sustainable development are controlled or even absent.

To lower the farmers' threshold to join the SFI, SFIs could include characteristics that concur with the other reported motive categories (e.g. knowledge exchange or business opportunities) or motivational processes (e.g. by introducing rewards, such as higher product prices or a sustainability certificate). Our research shows that many farmers have decided to join VL because of external rewards or pressure, e.g. obtaining a sustainability certificate, obtaining better product prices, or ensuring sales of agricultural products to chain actors. This adds to other findings that financial rewards are a main incentive for farmers to participate in a sustainability commitment (Luhmann, Schaper and Theuvsen, 2016). So, further research is needed to specify SFI characteristics that increase the accessibility of SFIs for farmers who are not autonomously motivated to work on sustainability. One research question could be: what are the SFI characteristics that attract farmers to participate in SFIs, given different motive categories and motivational process types?

Further, for obtaining long-term behavioural change regarding sustainability, external rewards alone are not sufficient (Mills *et al.*, 2016). More, SDT states that the introduction of external rewards (which we suggest may initially be used to attract farmers to participate) might undermine intrinsic motivational processes, which can subsequently result in less involvement and in farmer disengagement (Deci, Cascio and Krusell, 1975). Therefore, as suggested by Rico García-Amado *et al*. (2013), an analysis is needed of how to mix characteristics that meet both controlled and autonomous motivational processes. This is addressed in following subsection.

4.5.2 SFI characteristics for persistent farmer participation

Our research showed that other characteristics that feed autonomous motivational processes are needed to obtain persistent farmer participation. Persistent farmer participation (defined here as more involvement, engagement and performance) is, according to SDT, related to autonomous motivation (Vansteenkiste, Niemiec and Soenens, 2010). To attain these autonomous motivational processes, SFIs should therefore provide context characteristics in which internalisation is stimulated. According to SDT, this is possible by providing a context that supports satisfaction of the basic needs autonomy, competence, and relatedness (Ryan and Deci, 2000a).

Our respondents scored basic needs satisfaction high, which indicates that VL provides a good context for farmers to internalise VL's values. This is confirmed by the significant positive correlations between the basic needs satisfaction and autonomous motivation scores we found in our results. Our research also indicated that specific context characteristics of VL contributed to this basic needs supporting context, i.e. knowledge exchange in farmer groups, knowledge exchange between farmers and the VL organisation, knowledge exchange between farmers and chain partners, and the support for farmers to achieve their personal goals. Specifically, the knowledge exchange in farmer groups and the general support of farmers' achievement of personal goals seemed to be positively correlated to satisfaction of all 3 basic needs.

For competence satisfaction, only knowledge exchange in farmer groups and general support of farmers' personal goals showed significant correlations. Searching for a reason why, literature provides evidence that flexibility within SFIs is important to support a feeling of competence, because it recognises the farmers' skills and judgement to find solutions to specific problems for the specific farm context and to further develop farming related expertise (Siebert, Toogood and Knierim, 2006; Home *et al.*, 2014; Saxby, Gkartzios and Scott, 2017). SDT also states that providing structure supports competence satisfaction. Within the regional farmer groups, but also in VL in general, both flexibility and

structure are supplied. Structure is offered in farmer groups by using fixed formats in which a participants' sustainability plan is discussed, the participants' farm is visited, and in some cases an external expert is invited. In VL in general, structure is offered by giving the farmers instruments to deal with sustainable development and provide opportunities for knowledge exchange. Besides this, flexibility is key within the VL approach, as participants are able to use their skills and experience to find solutions for problems they face.

For relatedness satisfaction, our results show positive correlations with knowledge exchange in farmers groups, between farmers and the organisation, and between farmers and chain partners. This suggests that farmers feel valued by these parties and experience themselves as being crucial actors in the VL approach. According to SDT, this is decisive for the internalisation of behaviour (Ryan and Deci, 2000b).

For autonomy satisfaction, our results show positive correlations with all investigated specific context characteristics of VL. This suggests that VL's main instruments of knowledge exchange in its different forms (i.e. farmer groups, workshops with chain partners, interactions with farm advisors to draft the sustainability plan, interactions with the organisation) support the basic need for autonomy. This could be due to the bottom-up philosophy in VL, which is permeated in all these forms of knowledge exchange. For example, through drafting their own sustainability plan, VL participants choose which sustainability actions they will take, or, the regional farmer groups decide on the topics to discuss, based on (common) problems perceived by its members. Another interesting finding in our results is the relation between the perception of the VL participation rules and autonomy satisfaction and frustration. Participants who better accepted the participation rules scored higher on autonomy satisfaction and lower on autonomy frustration. This concurs with the SDT, stating that controlling conditions might erode the feelings of joy, enthusiasm or interest that accompany the inherent human interest in learning and developing knowledge (Niemiec and Ryan, 2009). Similarly, Stock and Forney (2014) found that externally imposed legislative regulations (e.g. environmental regulations) can undermine farmers' experiences of autonomy. As suggested in SDT (Jang, 2008), some authors therefore propose to sufficiently inform participants about the function and added value of rules (Smithers and Furman, 2003; Hynes and Garvey, 2009; Uyttenbroeck *et al.*, 2016). In this regard, VL has made important efforts to inform its participants about the (changed) participation rules by organising multiple information sessions on the implementation and benefits of the rules.

As only a few specific context characteristics were investigated in our research, other characteristics might equally influence basic needs satisfaction in SFI contexts, e.g. the active involvement of other actors such as consumers. Further focussing on why and

how these context characteristics influence basic needs satisfaction is necessary. Therefore, an important research question becomes, what are key SFI characteristics that support basic needs satisfaction and how do these SFI characteristics support persistent participation in SFIs?

4.5.3 Reflection on the socio-psychological approach

Some limitations of the exploratory research study should be addressed. First, the survey concept items showed inconsistency in several cases and some concepts were tested with a single item. Some difficulties arose from our finding that farmer motives could be assigned to 4 motive categories, and from our choice to question all types of motivational processes per motive category. The creation of these items sometimes seemed artificial and hard to interpret. It should be questioned whether all motivational process types are relevant for all content categories, also because some interdependence between different content categories seems to exist: e.g. farmers might be interested in knowledge exchange about on-farm sustainability or business opportunities. So by focussing on different motive categories, instead of merely one specific category (e.g. sustainable intensification) our research became more complicated, yet it allowed us to deliver a more complete picture.

Second, the limited sample size of our survey weakened the statistical power of our analysis. Further, given the limited sample size, it is possible that our respondent group represented farmers who perceived their participation in VL rather positively and therefore were also more willing to participate in our research (see also Smithers and Furman, 2003). Surveys gathering data from a larger farmer group could address these problems.

Third, we are aware that other factors besides farmers' motives, motivational processes and perception of the participation context possibly influence farmer participation in SFIs (e.g. farmer identity, socio-demographic characteristics; Charatsari, Lioutas and Koutsouris, 2016). For the purpose of this study, we focussed on farmer motivation and perception of the participation context.

Fourth, our research focussed on one specific SFI in the Netherlands, and is therefore framed within a western European context. Nevertheless, we believe that a further refinement of our approach could provide understanding on how a good SFI participation context can be created in other types of SFIs. An equal exercise can be performed in other cultural contexts.

Fifth, our research focussed on the relation between motivation and participation in SFIs, rather than the relation between motivation and the sustainable farming behaviour. Other research questions can provide information on the latter issue, which might be of

interest for SFIs. First, how does participation in an SFI influences the farmer's motivation towards on-farm sustainable development? This necessitates a longitudinal study on farmer dispositions, which has only scarcely been performed (e.g., Riley, 2016). Second, how does motivation influence the actual sustainable development on farms (and what are other decisive factors)? Further, aside from this research on farmer participation in SFIs, it would be interesting to investigate how the farmers' dispositions towards on-farm sustainable development are influenced by other networks they are involved in, because research has shown that different networks influence this disposition in multiple ways (Vandenabeele and Wildemeersch, 2010).

4.6 Conclusion

Although explorative, this study illustrates the potential value of investigating participation in SFIs in terms of farmers' motives, their underlying motivational processes and their perception of the participation context. From our results and discussion, we put forward two major conclusions on farmers' motives and motivational process to participate in an SFI and design characteristics of SFIs.

First, participants' motives are diverse, manifold, and directed by a diversity of underlying motivational processes. For our case, in order of decreasing importance, we observed 4 motive types: knowledge exchange, business opportunities, sustainability and social contact. When these motives are analysed using the SDT types of underlying motivational processes, we found that motives are directed by a diversity of underlying motivational processes, and that both are influenced by the SFI participation context. SDT proved to be a useful theory because it allowed us to picture the diversity of motives and motivational processes in social psychological concepts.

Second, the observed link between motives, underlying motivational processes and SFI context has implications for the design characteristics of SFIs that aim to attract farmers and to obtain persistent participation. With respect to the first goal (to also attract farmers who are not autonomously motivated for sustainability), SFIs need characteristics that (i) meet other motives than sustainability or (ii) stimulate other underlying motivational processes than the autonomous. With respect to the second goal, as persistent participation requires autonomous motivational processes, SFI characteristics must support satisfaction of the farmers' basic needs, autonomy, competence and relatedness. This conclusion thus indicates that SFI characteristics appropriate to attract farmers are not necessarily the same as those that successfully maintain persistent participation. For example, the Veldleeuwerik case shows that farmers can be attracted by offering rewards for participation, such as better product prices or sustainability labels for their products offered by the SFI. But, these

characteristics do not contribute to the satisfaction of basic needs and thus does not contribute to the autonomous motivation required for qualitative farmer participation. Although the way these basic needs are fulfilled should be defined context –specific, our results for the Veldleeuwerik case suggest that following SFI characteristics contribute to satisfaction of participating farmers' basic needs: a bottom-up approach, offering flexibility for farmers regarding the measures and actions to perform on their farm and the learning topics in the SFI, and clear information on why rules are needed or beneficial.

CHAPTER 5.

Communities of practice for knowledge co-creation on sustainable dairy farming: design criteria for value creation for farmers

This Chapter addresses R.Q. 2.2: *How do different design characteristics contribute to perceived value creation for farmers participating in an SFI?* In this Chapter we use the perspective of Communities of Practice to understand the dynamics related to the farmers' involvement in the social environment created by the SFI. In this Chapter, we investigate how participation in the activities of an SFI create value for them. We thus take the social interactions in which the farmers participate in the SFI as an entry point for the research in this Chapter.

This Chapter is based on following paper that is currently under revision in Sustainability Science :

Triste, L., Debruyne, L., Vandenabeele, J. , Marchand, F., Lauwers, L., Communities of practice for knowledge co-creation on sustainable dairy farming: design criteria for value creation for farmers

5.1 Introduction

To cope with complex challenges such as climate change, depletion of resources, global markets, and changing societal and legislative expectations, farmers must learn continually. Knowledge requirements comprise innovative technologies, farm management and day-to-day farming practices (Bergevoet *et al.*, 2004; Darnhofer *et al.*, 2010; Lankester, 2013). Knowledge creation and exchange take a central position when spurring sustainable production in agriculture (Wood *et al.*, 2014), but research results remain often unexploited,

unimplemented and not widely translated into practice (SCAR, 2012; Roux *et al.*, 2017). Although scholars argue that farmers need to be recognized as equal co-producers of knowledge (Sumane *et al.*, 2017), they often do not fully participate in the traditional (linear) process of (co-)creating knowledge between researchers and farmers (Schneider *et al.*, 2012; Hoffman, Lubell and Hillis, 2014).

Recently, novel models of knowledge creation and cooperation have been introduced (e.g., Eshuis and Stuiver, 2005; Curry and Kirwan, 2014; Novo *et al*., 2015). The aim is a science-society interaction for knowledge exchange in a mutual learning process (Moschitz and Home, 2014; Roux *et al.*, 2017; Sumane *et al.*, 2017). Regarding this so-called 'co-creation of knowledge', communities of practice (CoPs) are increasingly used as 'tools' for knowledge management (Oreszczyn, Lane and Carr, 2010; Wenger, Trayner and de Laat, 2011; Klerkx, van Mierlo and Leeuwis, 2012; Schneider *et al.*, 2012). Wenger *et al*. (2011) define CoPs as learning partnerships among people who find it useful to learn from and with each other about a particular domain, use each other's experiences of practice as a learning resource and join forces to address individual and collective challenges. In the context of sustainable development in agriculture, examples are Thematic Networks and Operational Groups within the European Innovation Partnerships (EIP)- Agri and the Learning and Innovation Networks for Sustainable Agriculture (LINSA) (Moschitz *et al*., 2015).

Although the value of such transdisciplinary initiatives is recognized within the research community (Hoffmann, Probst and Christinck, 2007; Roux *et al.*, 2017), knowledge is lacking about the kind of value created for farmers and what farmers perceive as valuable when participating in knowledge co-creation CoPs. Additional empirical research to guide researchers in setting up CoPs is therefore needed to refine our current understanding on knowledge exchange and creation (Reed *et al*., 2014).

Therefore, the goal of this paper is i) to examine value creation from a farmers' perspective in CoPs that aim for knowledge co-creation between farmers and researchers, and ii) to identify design features in the CoP activities that contribute to this perceived value creation by farmers. Research is done on two cases using a value creation framework (VCF) for CoPs developed by Wenger, Trayner, and Laat (2011). The cases were part of the European Interreg IV project 'DAIRYMAN' (INTERREG NWE, 2009-2013), in which CoPs for knowledge exchange and creation about sustainable dairy farming were set up in 13 regions in Europe.

In the next section, we theoretically reflect on knowledge exchange for sustainable agricultural development, why CoPs are an interesting concept and how value creation in

CoPs can be analysed using the value creation framework of Wenger *et al*. (2011). Then, we describe the two DAIRYMAN cases and their relevance for our analysis. After presenting the results, the discussion and conclusion generalize these insights to inform the design, and create maximal value in CoPs for sustainable development.

5.2 Communities of Practice as spaces for knowledge creation for sustainable agriculture

In the traditional knowledge creation process, farmers generally receive readily available explicit knowledge, easily shared in words or numbers (Nonaka and Takeuchi, 1995; Morgan and Murdoch, 2000; Curry and Kirwan, 2014). Explicit knowledge is usually supplied in a systematic manner by 'experts' such as researchers and advisors. Traditional knowledge creation neglects the farmers' expertise, which is mostly held as tacit knowledge, and their potential to contribute to knowledge exchange (Hoffmann, Probst and Christinck, 2007). Tacit knowledge is indispensable in sustainable agricultural development, because it is context-specific and holistic (Hoffmann, Probst and Christinck, 2007; Sumane *et al.*, 2017). It is rather difficult to explain or express, as it encompasses both a farmer's skills and crafts and his mental models, ideals and values (Nonaka and Takeuchi, 1995; van den Ban, 2002). Tacit knowledge can be shared through two types of processes (Nonaka and Takeuchi, 1995; Hoffmann *et al*., 2007). First, it can be learned through a relatively time-consuming "socialization" processes that involves practical experience, interaction or observation of people in practice (Wenger, McDermott and Snyder, 2002; Hoffmann, Probst and Christinck, 2007). Second, it can be transformed to new, explicit concepts in an "externalization" process, making it easily shareable and useful for future use in a broad group (Nonaka and Takeuchi, 1995; Hoffmann, Probst and Christinck, 2007). The incorporation of the concepts of socialization and externalization in knowledge co-creating processes is thus necessary, because of their potential to make farmers' tacit knowledge available and shareable. Several knowledge co-creation initiatives have already experimented with methods to exploit the potential of socialization and externalization processes (Bailey *et al.*, 2006; Hall and Pretty, 2008; Sumane *et al.*, 2017).

The theory of CoPs (Wenger *et al*., 2002), offers an interesting framework to investigate such initiatives, because it builds on the concept of participation in learning and knowledge creation. A CoP can be defined by three essential elements: domain, community and practice (Wenger, McDermott and Snyder, 2002). First, a clearly defined domain of knowledge motivates CoP members to participate and contribute, guides learning and gives meaning to action. Second, the community aspect fosters interactions and relationships, based on mutual respect and trust, and is critical for effective knowledge development and

sharing. In a community, three groups of participants can be defined according to their degree in participation: core, active and peripheral (Wenger, McDermott and Snyder, 2002). Third, the practice consists of the tacit and explicit knowledge the community develops, shares and maintains, originating from joint activities between CoP participants, e.g., a set of ideas, language or information, and more tangible outputs, like tools or documents (Wenger, McDermott and Snyder, 2002).

To obtain a rich picture of what CoP participants, including farmers, actually learn and value in CoPs, Bertram *et al*. (2016) and McKellar *et al*. (2014) recommend the value creation framework (VCF) designed by Wenger *et al*. (2011). Rather than merely evaluating quantitative and easily measurable output and outcomes, this framework supports the inclusion and triangulation of multiple sources and data types, including intangible or hard-to measure aspects such as CoP participant stories (Wenger, Trayner and de Laat, 2011; McKellar *et al.*, 2014). The VCF distinguishes 5 cycles of value creation, mirroring the richness of values created by CoPs, i.e., immediate, potential, applied, realized and reframing value (Wenger *et al*., 2011). *Immediate value (IV)* considers that networking activities and interactions have value of themselves for the farmers. *Potential value (PV)* refers to 'knowledge capital', the value of which lies in its potential to be realized later. *Applied value (AV)* refers to the adoption and application of the learned knowledge, practices and results in the farmer's personal life or on the farm. *Realized value (RV)* looks at the effects and successes of the applied knowledge for farmers. *Reframing value (RfV)*, reflects on changed understandings, strategies or goals and changes in the definition of what matters for the farmers. Although causal relationships exist between the cycles, no simple causal chain or hierarchy is assumed, nor does success necessarily coincide with reaching reframing value (Wenger *et al*., 2011). Acknowledging various value types generated by a CoP makes it possible to describe the complex relations between CoP activities, knowledge resources used and the produced and achieved results (Wenger, Trayner and de Laat, 2011).

5.3 Methods

5.3.1 Two DAIRYMAN cases: the Flemish and Northern Irish CoPs

The DAIRYMAN project (INTERREG NWE, 2009-2013) encompassed the construction of 10 so-called regional networks with 130 commercial pilot dairy farmers, 9 Knowledge Transfer Centers (KTC's), research institutions, advisory services and policy makers in 10 regions in North West Europe comprising 7 countries. First, a *core group* of researchers was involved in the European overall DAIRYMAN coordination and organization of

activities. Second, an *active group* of pilot farmers (who agreed to provide associated researchers with data and participate in specific project activities), KTC's (i.e. either experimental farms or agricultural schools on which technical research was performed and disseminated) and research institutes and/or advisory services were involved in regional and interregional activities organized by the core group. Finally, a *peripheral group* of stakeholders (e.g. policy makers, other researchers and farm advisors, other dairy farmers, foreign pilot farmers, …) were involved on an irregular basis. This study focuses on two regional networks, Flanders (Belgium) and Northern Ireland (UK). They were chosen because they reflect the regional network diversity in the overarching DAIRYMAN project, which will be exemplified in the results section. Although in the DAIRYMAN project description these two cases were referred to as 'networks', we will analyse them using a CoP-perspective, using the definition given by Wenger *et al*. (2011; see also in the introduction). In the following sections of this article we will use the elements of CoP theory to describe and analyse these cases. Table 5-1 gives an overview of the activities organized in the Flemish and Northern Irish cases.

Table 5-1. Regional activities for pilot farmers organized by the core team in Flanders and Northern Ireland.

	Activities	Flanders	Northern Ireland
Pilot farmer group activities	Regional farmer group meetings	Ca. twice a year Attended by all regional pilot farmers, the core group researchers, the KTC researchers and a project farm advisor. Each meeting had another sustainability topic (e.g. cow fertility, nutrient management, farm labor, etc.) Invited expert used pilot farm data	Ca. twice a year Attended by all regional pilot farmers, the core group researchers, private CAFRE advisors and the AFBI data collection scientists Presentation of generalized nutrient management figures to compare derogated and non-derogated farms
	Regional farm visits	Visits to pilot farms Attendance of a farm advisor Not all pilot farms were visited	
	Interregional exchange visits	Visits to pilot farms and KTCs in other regions. Flemish pilot farmers visited Brittany, Pays de la Loire, Northern Ireland and The Netherlands during three visits. The Northern Irish pilot farmers visited Brittany, Pays de la Loire and The Netherlands during two visits. Some (thematic) meetings with the DAIRYMAN participants abroad. Attendance of the core group researchers and at least one project farm advisor. Completion of feedback forms by the visiting farmers to define interesting aspects and areas of improvement for the visited farms.	
	Meetings with stakeholders	Pilot farmers meet peripheral stakeholders	Pilot farmers visit Parliament Buildings and talk to regulators.
	Activities of the Knowledge Transfer Centers (KTCs; i.e., experimental farms or agricultural schools)	Demonstrations and trainings for farmers Perform and disseminate technical research to pilot farmers and other dairy farmers	
Individual pilot farmer activities	Peripheral visitors on the farm	Farm visits by students, advisors, policy makers or researchers and foreign pilot farmers. Not on all pilot farms	
	Farm Development Plan (FDP)	Draft of FDP at the start of the project together with one or both of the farm advisors, a researcher and the pilot farmer. Proposition of targeted actions to increase on-farm sustainability, e.g. lower in-between calving period, reduce energy-use from the public net, etc. . No evaluations during or at the end of the project	Draft of FDP via consultation between the pilot farmer and the on-farm advisors, Proposition of strategies, indicators and targets to achieve farm development objectives Part of a comprehensive approach that fit into a regional master plan aimed at achieving more efficient nutrient management to meet the targets of the EU Nitrates Directive. FDPs were closely linked to on-farm research and included at least one environmental, one business and occasionally social objectives. To achieve their targets, grants were offered to test on-farm investments. Regular reporting on the farm development progress made regarding nutrient management
	On- farm research	One analysis of a soil sample No further specific on-farm research	Analysis of on-farm soil, grass and slurry samples on N, P, K by the researchers Provision of a full nutrient balance of the pilot farms. Building of farm nutrient balance maps, showing the plots with a shortage or surplus in nutrients. Analyses used to provide specific advice towards farmers. Follow up of farm progress.

In the Flemish case, the active community consisted of a core group, including a research institute and an experimental farm acting as KTC, and an active group, including two farm advisors (one associated with an Extension Research Centre and one associated with a farmer organization), and twelve pilot farmers. Although they had no permanent working relationships, there were some existing links between the farm advisors and the pilot farmers, e.g., through joint participation in previous research projects. Farmers were recruited to the project by the farm advisors. All farmers kept records and accountancy data about their farming practices before DAIRYMAN started. The aim of the Flemish case was to bring together a group of pioneering farmers and to exchange learning experiences on sustainable dairy farming in broad sense.

In Northern Irish case, the active community consisted of a core group, including a research institute and two KTCs (i.e. an experimental farm and an agricultural school that also offered farming advice), and an active group of nine pilot farmers. The research institute and KTCs had a history of close cooperation, and a strong tradition of sharing research with commercial farms, also using commercial farms for on-site demonstrations. Pilot farmers were selected from participants in an earlier project on improved nutrient management. All pilot farmers had a good, and often long-lasting, relationship with an advisor, who already knew the farms well. Several farmers had also acted as 'focus farms', welcoming other farmers onto their farm to disseminate and demonstrate knowledge. The aim of this case was to create knowledge on the challenges and possibilities to meet the EU Nitrate directives in Northern Ireland.

5.3.2 Data collection

We conducted 15 in-depth semi-structured interviews with ten Flemish and five Northern Irish pilot farmers to gain insight into the values they attributed to participating in DAIRYMAN. We interviewed all farmers that were found willing to contribute to our research. In Northern Ireland, the interviews were attended by one of the project advisors involved in DAIRYMAN. This, as well as the culture of not criticizing others, might have influenced the Northern Irish farmers to freely assess some design features. Additionally, we interviewed five (three Flemish and two Northern Irish) regional key persons actively involved in the interregional project coordination. They provided information on the regional network activities and helped to contextualize what was said in some of the farmer interviews. Furthermore, we used documents on regional activities offered by the regional core teams.

To structure our interview guide (see Annex 2), we used the value creation framework (VCF). First, we asked pilot farmers why they decided to participate in

DAIRYMAN. Other questions focused on the perceived values of participating in DAIRYMAN. For *immediate value,* we asked about what they remembered best of their participation, with whom they interacted the most, and how they felt about their involvement in the project. Regarding *potential value,* we asked about the new knowledge, skills and techniques they acquired, whether participating in DAIRYMAN changed their knowledge on sustainable dairy farming, and any other benefits they attributed to their participation. Regarding *applied value,* we asked whether they applied newly retrieved knowledge, skills and techniques on their farm, and whether they made use of the reports and documents produced by DAIRYMAN. Regarding *realized value,* we asked what the applied value yielded for them. Regarding *reframing value*, we asked whether participating in DAIRYMAN influenced their perspective on dairy farming.

The interviews with key persons were performed at the end of the project in 2013, with all activities fresh in mind. As a certain time lag is recommended to allow effects to arise (Walter *et al.*, 2007), the interviews with the pilot farmers were performed in 2015, approximately 2 years after DAIRYMAN ended. This allowed farmers to assess the realized and reframed value of their participation in the project. However, in some interviews, 2 years seemed a long period to clearly recall the immediate, potential and applied value. We addressed this by asking them about specific activities when they did not mention them spontaneously during the interview.

5.3.3 Data analysis

Interviews and project documents were transcribed and coded in NVivo11. The codes were attributed to the value types, regional activities, and the 3 theorized structural elements of CoPs (i.e. domain, community and practice development, see Section 2). Although otherwise suggested by Wenger *et al*. (2011), we decided to include both positively and negatively valued activities and experiences. We followed a two-step approach. First, based on our interviews, values were attributed to activities. Second, based on the questions why farmers valued specific activities, we were able to identify specific features that contributed (or not) to the perceived value creation for farmers. Results are given in Table 5-2 and Table 5-3. Using a comparative case-study approach (Yin, 2003), our results section focuses both on similarities and differences of features valued by Flemish and Northern Irish farmers. We refer to Box 1 as an illustration of how we attributed the values to the features in Table 5-3.

Box 5-1. Illustration on how we attributed the values to the CoP features

We use the feature "Generating (technical) farm- specific knowledge" as evaluated by the Flemish pilot farmers to illustrate how the perceived values by farmers are attributed to CoP features (Table 5.3). We use following abbreviations for the 5 value types: IV for immediate value, PV for potential value, AV for applied value, RV for realized value, RfV for reframed value. According to a positive ("+") or negative ("-") perception each value by farmers, a sign is added to these abbreviations.

"Generating farm-specific advice" in Flanders can be linked to activities that allowed discussion on on-farm management; e.g., receiving visitors on their farm and the farm development plan (FDP) contributed to the generation of farm-specific advice (Table 5.2).

In general, the Flemish pilot farmers criticized the lack of on-farm research and accompanied farm-specific advice (-IV). The FDP had the potential to be an important source of farm-specific advice, but as only one farmer mentioned it in the interview, we assume that the pilot farmers did not attribute great value to the FDP (-IV). Overall, they stated that the project output provided rather general information that was not practical nor farm-specific (-PV), and therefore some pilot farmers did not mention applying new practices on their farm due to the project (-AV). The limited involvement of farm advisors and the limited attention given to the FDPs have likely contributed to this. The pilot farmers mostly agreed that the project provided them little direct measurable added value (-RV), and stated that in future they would only participate in a similar project if it would include on-farm research and advice (+RfV).

5.4 Results

5.4.1 Overall value creation in the cases

In both cases, participation led to value creation for the pilot farmers in all five value types (Table 5-3). What they perceived as valuable differed in both regions and relates to the regional activities that were organized (see further 5.4.2 – 5.4.4). Regarding the immediate value, pilot farmers felt honoured to participate in DAIRYMAN and perceived participation as useful, interesting, fun, and even exceeding expectations. The immediate value related to activities, such as the farm visits abroad, the farmer group meetings, the informal chats, the on-farm research, and the interactions with peer farmers, advisors, and/or researchers. Regarding the potential value, what they learned was often related to the farmer's interest and their farm management. Farmers referred to the provision of technical knowledge (e.g. on injecting slurry, cow fertility, soil fertilization), gaining insights in others' perspectives,

expanding their network, some tangible resources like farm leaflets and nutrient management plans, and the recognition for their farming practices. Regarding the applied value, farmers applied techniques and ideas they had picked up during farm visits, farmer group meetings, or on-farm research and advice; e.g. growing fodder beets, cross breeding, adjust the grazing system. Further, they made use of their expanded network or tangible resources produced. Regarding realized value, in both regions the application of knowledge resulted, for example, in saving money, obtaining financial surplus for the milk or lowering the labour. Regarding reframed value, farmers mentioned changed perspectives on farm management and sustainability, e.g., increased inclusion of ecological issues into farm management or a broadened interpretation of on-farm sustainability..

Pilot farmers generally related the value types, to certain regional activities, and, more in particular, to specific features or elements of a certain activity. As a result, we could identify a set of 17 distinct features, linked to different regional activities, which have influenced the domain, community and practice development (Table 5-2), and the five types of value created, in both regions. In the next paragraphs, we will elaborate on the features that were implemented in the two regions (Table 5-2), and, at the same time, describe how farmers valued them in the domain, community and practice development of the cases (Table 5-3).

Table 5-2. Relation between CoP features and regional activities in Flanders and Northern Ireland.
An "X" means that the feature was incorporated in or contributed to an activity.

		Flanders								Northern Ireland							
		Pilot farmer group activities					Individual pilot farmer activities			Pilot farmer group activities					Individual pilot farmer activities		
	CoP features	Farmer group meetings	Regional farm visits	Interregional exchange visits	Meetings with stakeholders	KTC activities	Peripheral visitors on own farm	Farm Development plan	On- farm research	Farmer group meetings	Regional farm visits	Interregional exchange visits	Meetings with stakeholders	KTC activities	Peripheral visitors on the farm	Farm development plan	On-farm research
Domain development																	
1	Broad definition of sustainability	x						x								x	
2	Clear goal definition									x				x		x	x
Community development																	
3	Open and progressive pilot farmers	x	x	x	x	x				x	x	x	x	x			
4	Researchers with technical knowledge on dairy farming	x	x		x	x				x	x	x	x	x		x	x
5	Farm advisors as translators between researchers, experts and farmers	x	x	x	x	?	x	x		x	x			x	?	x	x
6	Experts on diverse sustainability topics	x															
7	Other stakeholders related to dairy farming				x		x						x		x		
8	Interactions with regional peer pilot farmers	x	x	x	x	x				x	x	x	x	x			
9	Communication on research performed within the project towards farmers	x		x	x	x				x		x	x	x			x
10	Clear role division between researchers, farmers, advisors									x					x	x	x
11	Division of means between farmers, advisors and researchers					x		x	x					x		x	x
Practice development																	
12	On -farm visits		x								x						
13	Visiting foreign farmers			x			x					x			x		
14	Informal interactions	x	x	x	x	?				x	x	x	x	?			
15	Farmer involvement in research													x		x	x
16	Generating (technical) farm-specific advice						x	x		x						x	x
17	Dissemination of research results to wider dairy community				x								x		x		

Table 5-3. CoP features of the cases and their contribution to different types of value creation in both cases.
+ : positively valued by two or more pilot farmers; (+): positively valued by one pilot farmer; -: negatively valued by two or more farmers; (-): negatively valued by one farmer; 0: not specifically mentioned by the farmers; N.A.: this feature is not applicable for this regions and/or value. Design features that contributed to a great extent to all types of value creation according to the farmer's perceptions are shaded.

		Flanders					**Northern Ireland**				
	CoP features	***Immediate value (IV)***	***Potential value (PV)***	***Applied value (AV)***	***Realized value (RV)***	***Reframed value (RfV)***	***Immediate value (IV)***	***Potential value (PV)***	***Applied value (AV)***	***Realized value (RV)***	***Reframed value (RfV)***
Domain development											
1	Definition of sustainability	+	+	*(+)*	*0*	+	*0*	*0*	*0*	*0*	*0*
2	Clear goal definition	-	-	*0*	-	*0*	*0*	*0*	*0*	*0*	*0*
Community development											
3	Pilot farmers with an open attitude	+	+	*(+)*	*(+)*	+	+	+	+	*0*	+
4	Researchers with technical knowledge on dairy farming	-	-	*0*	*0*	*0*	+	+	+	+	*0*
5	Farm advisors as translators between researchers, experts and farmers	+	+	*(+)*	*0*	*0*	+	+	+	+	*0*
6	Experts on diverse sustainability topics	+	+	+	+	*0*	*N.A.*	*N.A.*	*N.A.*	*N.A.*	*N.A.*
7	Other stakeholders related to dairy farming	-	-	*0*	-	*0*	+	*0*	*0*	*0*	+
8	Interactions with regional peer pilot farmers	+	+	+	*(+)*	+	+	+	*0*	*0*	*0*
9	Communication on research performed within the project towards farmers	-	-	*0*	*0*	*0*	+	+	+	+	+
10	Clear role division between researchers, farmers, advisors	-	-	*0*	*0*	*0*	+	+	+	+	*0*
11	Division of means between farmers, advisors and researchers	-	-	*0*	-	*0*	+	+	+	+	*0*
Practice development											
12	On farm visits	+	+	+	+	+	+	*(+)*	*0*	*0*	*0*
13	Visiting foreign farms	+	+	+	*(+)*	+	+	+	+	*(+)*	+
14	Informal interactions	+	+	*0*	*0*	*(+)*	*(+)*	*0*	*0*	*0*	*0*
15	Farmer involvement in research	-	-	*0*	-	+	+	+	+	+	+
16	Generating (technical) farm-specific advice	-	-	-	-	+	+	+	+	+	*(+)*
17	Dissemination of research results to wider dairy community	+	*(+)*	-	-	*0*	*0*	*(+)*	*0*	-	*0*

5.4.2 Domain development

The domain of knowledge in DAIRYMAN was sustainable dairy farming in a broad sense. Regions were free to cover a wide range of economic, ecological and social topics. The Flemish case fostered this broad interpretation of sustainability (Feature 1) by discussing social, economic and ecological themes in the farm development plans (FDPs) and farmer group meetings (Table 5-2). This contributed to immediate, potential and reframed value creation for the Flemish farmers, because the themes interested them, inspired them to rethink farming practices, ensured them to take ecological considerations into account when making new investments, and contributed to a broader understanding of the sustainability concept (Table 5-3). However, some farmers mentioned a lack of in-depth analysis and continuity on certain sustainability themes, because of the limited number of farmer group meetings to cover the various themes. Farmers also indicated that the project's goal was not entirely clear from the start (Feature 2), and that communication about the research performed within DAIRYMAN was too limited (Feature 9). As a result, farmers only became aware about the case's potential, and their role in it, towards the end of the project. According to the farmers, this contributed to a lack in potential and realized value creation.

In Northern Ireland, the domain and regional activities were more focused on the nutrient management aspect of sustainable farming, building on work done in earlier projects, involving also the DAIRYMAN pilot farmers were involved. As a result, farmers were much more aware about the purpose of the project and their role in it. The farmers did not specifically mention how they valued this rather narrow interpretation of sustainable dairy farming (Feature 1), but as they applied a lot of knowledge generated during the project, the topic was clearly of interest for them.

5.4.3 Community development

5.4.3.1 Community members

Our results reveal 5 distinct features regarding community members in the active, core and peripheral group. First, farmers in both regions valued pilot farmers with an open attitude (Feature 3), who experimented frequently, were critical thinkers and easily shared farm data and experiences. These features contributed to almost all value creation types. However, farmers did act differently in both regions. In Flanders, the farmer group had an open stance towards sharing farm data and figures with other pilot farmers and researchers, while the Northern Irish farmers were more reluctant to share their farm data in group. Possible reasons could be fear for controlling bodies and a stronger tradition of keeping personal data private.

A second important feature was the technical farming knowledge of the researchers (Feature 4). In Flanders, the core group researchers had limited expertise in everyday dairy farming practice. They had a profile as social scientist or as technical expert. The Flemish pilot farmers criticized this lack of knowledge on dairy farming, as they felt that this hampered the potential co-creation of knowledge. In Northern Ireland, the core group researchers had a long history in dairy and nutrient research. This enabled the provision of applicable farm-specific advice, creating applied and realized value for farmers.

Third, in both regions, farm advisors were depicted as key persons in the project, as they allowed translation of research and technical knowledge into applicable (regional) practical knowledge for the farmers (Feature 5). In Flanders they played an active role during farmer group meetings, farm visits and the farm development plans (Table 5-2) by providing in-depth information on visited farms, facilitating in-depth discussions by asking pertinent questions, helping farmers to process more theoretical information, and being available to provide advice. The farmers would have liked to see them more involved in the project, but their budget, and thus available time, was limited in the project, which is reflected in the lacking creation of applied and realized value (Table 5-3). In Northern Ireland, advisors played a major role in the farm development plans and on-farm research (Table 5-2). They were the persons the pilot farmers interacted with the most during the project, and they translated on-farm research results into applicable farm advice.

Fourth, in Flanders, experts were invited to farmer group meetings to expand upon the various sustainability topics (e.g. animal fertility, soil management, labour, etc.) (Feature 6; Table 5-3). They were valued by most pilot farmers as they mentioned some interesting applicable practices, which led directly to financial and/or labour savings. They also directed farmers to available information on different topics that could be consulted afterwards, e.g., an overview of the labour income per litre milk. In Northern Ireland, as the overall focus was nutrient management, the researchers acted as experts and no external experts were involved.

Fifth, in both regions the farmers recognized the value of involving stakeholders from the government and influential bodies in the dairy sector (e.g. dairy processors, policy makers, farmer organizations) (Feature 7). The Flemish farmers were eager to discuss on-farm figures and practices with these stakeholders, but felt the project did not succeed in this regard. They stated that the lack of involvement diminished the realized value for the dairy community as a whole. The Northern Irish farmers specifically valued their interaction with otherwise inaccessible parties during a meeting in the Northern Ireland Parliament Buildings, because it contributed to reframing value creation by broadening their perspective on sustainability and dairy farming.

5.4.3.2 Community relationships and roles

Both communities were nurtured through pilot farmer group activities, in which farm management was discussed with peers, advisors, researchers and experts and through individual pilot farmer activities. In Flanders, more attention was given to group activities while the Northern Irish case put more emphasis on individual pilot farmer activities. The frequent interactions between the Flemish pilot farmers (Feature 8) contributed to a strong community feeling. This is reflected in the immediate, potential and applied valued creation attributed to the well-connected group, the social contacts, the possibility to confidentially discuss farm management, and the enduring and beneficial expansion of their network with peers. In Northern Ireland, the pilot farmer activities only started during the last two years of DAIRYMAN, and the lower frequency in pilot farmer interactions (Feature 8) resulted in limited value creation. Nevertheless, they were valued, because sharing problems became easier and they experienced the foreign trips as fun. However, the expanded network did not result in maintained social contact after the project ended. The Northern Irish farmers stated that the community had only sufficiently developed to start functioning as an open discussion group at the end of the project.

Relationships between farmers and researchers were perceived as good in both regions, but the communication about research performed within the project towards farmers is differently perceived in both regions (Feature 9). In Flanders, farmers felt they were neither involved in, nor informed enough about the research activities in the project. As a result, they felt that their data was exploited without benefit to them. In contrast, the Northern Irish farmers felt that the researchers and advisors informed them frequently about the research being done, e.g. during farmer meetings and through advice given during on-farm research activities. The farm-specific advice contributed to applied and realized value, because it motivated farmers to change their fertilization management. Communication about more general research results contributed to reframed value as it made farmers aware about pollution risks in the area and also motivated them to take ecological considerations on their farm into account (Table 5-3).

The different focus in farmer group versus individual activities and the differences in domain development between both regions (5.4.2) also influenced the values attributed to role divisions (Feature 10) and divisions of means (Feature 11) within both cases. The Flemish case could not rely on pre-existing relations and division of labour. The farmers felt that roles were not entirely clear at the start and the clarity about roles developed slowly during the project. They criticized the lack of an active role for farmers in the knowledge creation process and felt they could have played a more central role in it, e.g. by providing more (detailed) farm records and performing on-farm experiments, thus adding to the

potential and realized value of the project. Some felt not challenged enough during the pilot farmer meetings and thought the meetings were more valuable for the researchers than for themselves. The lack of a role for farmers in the knowledge co-creation process with researchers was also reflected in the division of means in the Flemish case, with only a small fraction of the budget going to on-farm research and farm advisors. The farmers stated that the project budget did not concur with the value created for them or the dairy sector, and the uneven budget distribution limited the potential development of farm-specific knowledge. Despite the awareness, also with the researchers, about this shortcoming, the project design did not offer any possibility to reallocate the means.

In the Northern Irish case, the cooperation in previous projects resulted in clear role divisions between farmers, researchers and advisors in both research and dissemination. During the on-farm research, pilot farmers provided records, advisors took samples, researchers analysed samples, and advisors and researchers translated them into applicable on-farm strategies and advice. This role division contributed to the pilot farmers' perception of being part of a knowledge creation process, motivated them to keep records and this record keeping continued even after the project ended. This contributed to the immediate, potential, applied and realized value creation. This role division was also reflected in funding for farm samples and analyses, grants for on-farm investments and sufficient means for advisors to provide advice. Furthermore, as some of the Northern Irish pilot farmers were focus farms, they also had a role to play in the dissemination of information. This contributed to the realization of knowledge exchange in the wider dairy community. Finally, farmers also valued the researchers' and advisors' role in testing innovative practices and techniques on the KTCs. These tests resulted in applied and realized value as they often inspired by farmers, and decreased the risk of applying these practices on-farm.

5.4.4 Practice development

For both regions, there is plenty of evidence of DAIRYMAN's practice development, including reports on organized activities (e.g., farm monitoring activities, discussion groups, farm visits), research reports, newsletters, tools, website (http://www.interregdairyman.eu/en/dairyman.htm). In both regions, the farmers stated that participating in DAIRYMAN educated them as a farmer and they regret that it ended. They learned a great deal (potential value creation) but did not necessarily apply the new information. Participation in activities was considered as a good way of learning, because it contributed to reframed value creation through the real-life observations that allowed them to incorporate little bits of knowledge that eventually led to mindset changes. Both farmer

groups state that only at the end of the project the communities were developed enough for optimal co-creation (Flanders) and dissemination of knowledge (Northern Ireland).

Multiple features of the regional activities contributed to practice development. First, there is the feature of visiting peer farmers, both locally and abroad (Features 12, 13). The farm leaflets used during the visits, created potential value, as they gave a quick overview of the farm's relevant information, were highly valued because they eased discussion during visits and acted as mnemonics afterwards. In both regions, farm visits were highly valued as they created potential value through real-life observations. Although some pilot farmers mentioned the difficulty of applying inspiring examples from other farming contexts, some did implement practices they saw on others' farms. Further, farmers valued getting acquainted with legislative, cultural, and physical aspects of other farming systems and contexts (both regional and abroad). The diversity of visited farms offered them the opportunity to critically reflect on both others and their own farming practices. Furthermore, farmers valued visiting their peers' farms because it provided insights into their ways of thinking and fostered mutual discussions on farm management. During the interviews, these regional farm visits were less mentioned by the Northern Irish farmers, possibly because visiting the pilot farms was not systematically taken up in the regional activities. Particularly the exchange visits, where farmers from one region had the opportunity to visit 2 or 3 other regions during the course of the project, were depicted as the most remarkable and unique experience of the project. They contributed to immediate, potential value and reframed value creation because they created an opportunity for farmers to travel, gave them a good feeling about their farming culture (specifically in Flanders), motivated them to do better in their own farm (specifically in Northern Ireland), created awareness about their position in the European dairy context and changed their interpretation of what a good farmer entails. The Northern Irish farmers were most impressed by visiting the Dutch farmers, due to their openness and the high standard of their farms.

Second, the project created room for informal conversation (Feature 14) between farmers, researchers, advisors, or other stakeholders such as during dinner, in the car or bus, before or after an activity, and during social activities (Table 5-2). This feature contributed to immediate and potential value creation as it enabled deeper one-to-one discussions that gave them insight into their peers' ways of thinking, a more thorough understanding of what they had seen, farm-specific advice through interaction with the farm advisor, an update on developments in the project through interaction with the researchers, etc. A Northern Irish farmer argued that the foreign visits lacked social activities creating room for such informal interactions, which was possibly enforced by the smaller number of group activities in Northern Ireland.

Third, despite the different implementation in both regions, pilot farmers highly valued participating in and contributing to research (Feature 15). Having seen the communities' potential in other regions (e.g., The Netherlands), pilot farmers in Flanders indicated they were eager to contribute to research proposals, to give advice on KTC investments, or to perform tests and experiments. However, they were hardly involved in actual research, because of the way the Flemish case was organized. In Northern Ireland, the pilot farmers were involved in research through the KTC activities, FDPs and on-farm research (Table 5-2).). It contributed to immediate and potential value creation, as they were being involved in KTC research and being informed about research progress during pilot farmer meetings. Further, the on-farm research provided them with detailed nutrient management data for their farm. This enabled them to take directed actions for improvement, which benefitted them financially and thus contributed to applied and realized value creation. Close involvement in activities such as the soil analysis changed the farmer's perspective and encouraged the farmers to also consider ecological issues when making nutrient management decisions (Reframing value creation).

Fourth, in both regions farmers seemed mostly interested in farm-specific applicable knowledge (Feature 16). The Flemish farmers stated that the project output hardly provided them practical, farm-specific knowledge that resulted in measurable added value. Insufficient involvement of farm advisors, inadequate follow-up of the FDPs, the lack of on-farm research and limited feedback during visits on their farm have likely contributed to this. Farmers stated that in the future they would only participate in a similar project if it would include on-farm research and farm-specific advice. In contrast, the Northern Irish individual pilot farmer approach contributed greatly to this feature (Table 5-2). The farmers perceived the combination of the analysis, advice and feedback provided by the on-farm research as a real service to them, contributing to applied and realized value. The pilot farmers highly valued the nutrient balance maps that resulted from the on-farm research and were used for fertilization advice, even after the project ended.

Fifth, in both cases, farmers felt dissemination of research results was limited (Feature 17), because its output was not well known in the dairy sector and other dairy farmers were not able to benefit from the project. In Flanders, dissemination of research mainly occurred through articles in farmer journals, the project website, reports and KTC demonstrations provided by the core group. In general, the farmers attributed little value to resources produced by the core project teams, because: (i) most documents and the website were published in English, were rather general and provided too little technical information; (ii) tools provided on the website were perceived as too complicated and region-specific for application on their farms; (iii) KTC activities did not interest the pilot

farmers. Some farmers subscribed for newsletters of DAIRYMAN KTCs and research centres to keep up with developments and innovations. Some farmers did value the potential of being known as a DAIRYMAN farmer, thus receiving visitors. In Northern Ireland, the pilot farmers also attributed limited value to the resources. Despite their role in the dissemination of project results, they did not mention it in the interviews. Researchers and farmers believe the project stopped too early to enable dissemination of relevant information to other dairy farmers. However, in both regions, the core teams were not able to find ways to continue the regional activities after the DAIRYMAN[7] funding ended.

5.5 Discussion: CoP features supporting knowledge co-creation.

Our research allows to identify 17 features that contributed to value creation for farmers in our cases. The VCF proved to be a useful tool, because it helped pilot farmers to express what they valued in the DAIRYMAN project and stimulated them to reflect on their learning (Bertram, Culver and Gilbert, 2016). Features that were present in one region and valued by its pilot farmers, were often perceived as missing in the other region where this feature was less present in the activities. Our results also clearly indicate that, within our cases, features differently contributed to value creation for farmers. Moreover, our results show that some activities and design features are likely to contribute better to the creation of specific value types then others. For example, immediate value resulted from group activities and pleasant relationships with other actors in and stakeholders of the community. This seemed more developed in the Flemish case, that put a bigger emphasis on group activities and thus fostered a good relationship between farmers. Potential value mainly resulted from all types of activities that provided technical knowledge and tangible resources that might be of value on the farm, e.g. provision of information by experts and/or researchers, real-life observations during farm visits. Applied and realized value for farmers could be attributed to activities and features that contributed to the generation of farm-specific knowledge, e.g. on-farm research, the attendance of advisors. As these features were specifically apparent in Northern Ireland, applied and realized value were more prominently created in this case. Finally, we observed indications that reframing value was achieved, e.g. farmers started to take into account ecological considerations in their farm management or broadened their vision on the sustainability concept which they incorporated in farming practices, farmers often found it hard to state that reframing took place and stated that it might have happened unconsciously. This may have been addressed better by including more reflection activities in both cases.

[7] Both regions are involved in the EU Horizon2020 project EuroDairy, albeit with other project partners and farmers.

A lot of our findings confirm existing research on transdisciplinary and knowledge exchange initiatives (Raymond *et al.*, 2010; Reed *et al.*, 2014; Belcher *et al.*, 2016; Mann and Schäfer, 2017; Roux *et al.*, 2017), e.g. the influence of the project duration on community building and value creation (Roux *et al*., 2017), the need to include flexibility into the project design (Reed *et al.*, 2014), or regular evaluation and reflection moments to focus the domain and elicited frustrations of the project participants (Belcher *et al.*, 2016; Mann and Schäfer, 2017). In the following sections we discuss which specific features are beneficial for knowledge co-creation for sustainable agriculture based on the value attributed to them by farmers.

5.5.1 Conscious consideration of the domain

Our results show that the definition of the domain should be considered consciously, also taking into account project duration. The rather specific focus on nutrient management in the Northern Irish case allowed thorough knowledge creation within the specific timeframe of the project. In Flanders, despite the recognized value of the broad interpretation of sustainability, sustainability themes lacked in-depth attention because of time constraints and it took some time for both researchers and farmers to clearly picture what could be realized in the project.

5.5.2 Valued actors and competencies in the knowledge creating community

Our research confirms earlier findings claiming that community building is fostered through pre-existing relationships, regular group meetings, and informal interactions (Reed *et al*., 2014) and that a peripheral group of influential stakeholders should be involved (Esparcia, 2014; Reed *et al.*, 2014).

Further, our results suggest that specific competencies are required for the involved CoP actors. First, our results confirm findings of Sewell *et al*. (2017) that the farmers should have an open attitude towards other perspectives, experimentation and sharing personal data and practices with others. Koutsouris *et al*. (2017) more specifically described required characteristics for “demonstrating” farmers. However, one could question whether the characteristics or competencies of farmers “receiving” knowledge should be the same or different.

Second, as mentioned by Belcher *et al*. (2016), our research shows that the researchers involved should have some (practical) expertise in the CoP domain, as it enables more valuable contribution in discussions and adds to the farm -specific knowledge creation process. Our results are not entirely clear about whether this role can be substituted by “external” experts who are not involved in the core or active CoP groups, as was the

case in the Flemish group. Based on our research, we are inclined to believe that simply an expert cannot substitute this role, as also other requirements need to be fulfilled, e.g. the continuous presence of a facilitator with broad knowledge on the CoP domain to facilitate the knowledge creation process. But, further research is needed to confirm this.

Third, our research confirms recent studies stressing the important role of advisors as translators or "bridging agents" (Roux *et al.*, 2017), constantly combining tacit and explicit knowledge, in the continuation, application and dissemination of knowledge (Werr and Stjernberg, 2003; Klerkx and Proctor, 2013; Roux *et al.*, 2017; Sumane *et al.*, 2017). As farmers specifically valued the generation of farm-specific knowledge, we suggest to have sufficient attention and budget in knowledge co-creation projects to enable the advisors' translating role. However, the advisors' competencies are also important. Ingram (2008) found that advisors can be very differently involved in encounters with farmers. She found that specifically advisors competent in communicating, empathizing and listening, being impartial, technically capable, and valuing farmers' insights are most effective for knowledge exchange aimed at sustainable agricultural development. This seems like a good start in defining the required advisor competencies for knowledge co-creation initiatives on sustainable development on farms, but should be further investigated in this specific context.

5.5.3 The complementary value of two knowledge creation processes for practice development

The practice development includes the actual knowledge co-creation processes. Three specific characteristics for knowledge co-creation activities (i.e. the practice development), as valued by farmers, emerge from our research. The first is the importance of transferring inspirational practices and technical knowledge in such a way that farmers can implement it on their farm, as it contributes to the potential, applied and realized value creation. The second characteristic that farmers value are first-hand experiences, e.g. through farm visits or participation in on-farm research, which confirms the research of Franz *et al*. (2010). The third characteristic, similar to Wenger *et al*. (2002), refers to a crucial balance between pilot farmer group activities and individual pilot farmer activities, as both contribute differently to value creation for farmers. Group activities are valued for community building (thus contributing to immediate value) and to become familiar with other's perspectives on dairy farming also in other contexts (thus contributing to potential and reframing value). Individual activities were specifically valued for in-depth, preferably farm- specific, knowledge creation (thus contributing to applied and realized value).

Based on our research, and taking into account these three characteristics, we distinguish two processes of knowledge co-creation that are equally important as they differently contribute to value creation for farmers. These are pictured in Figure 5-1, in which the relation between farmers and advisors forms an important shared axis, as also stressed in section 5.5.2.

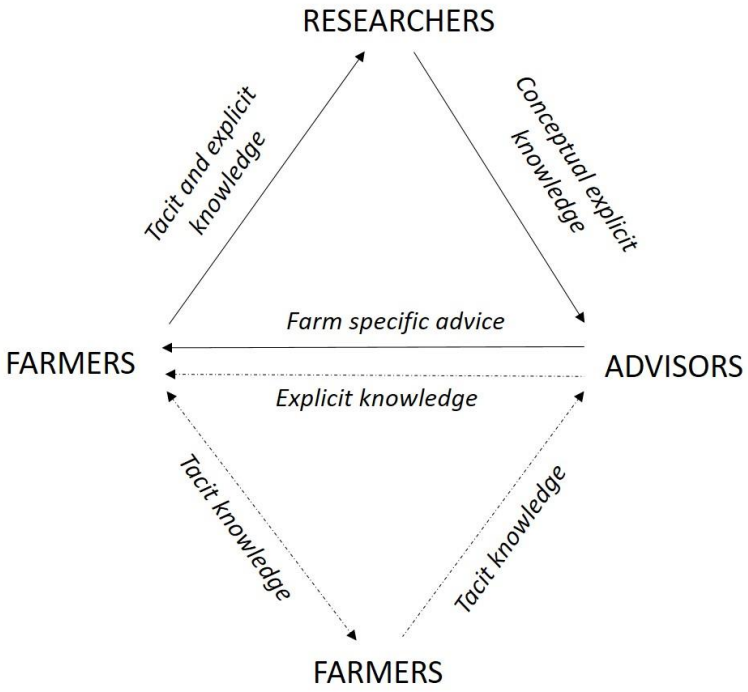


Figure 5-1. Two balancing triangles for knowledge creation within the DAIRYMAN CoPs.

The first process (upper triangle in Figure 2) is based on the dynamic interactions and clear role divisions between researchers, farm advisors and the individual pilot farmers, as observed in Northern Ireland. The on-farm research and farmers' record keeping provided valuable farm-specific knowledge for research purposes. These various data sources were combined and translated into more conceptual knowledge by researchers, after which this was further translated by the advisors to farm-specific, practical information for pilot farmers. This was done both explicitly in the form of nutrient balance maps and tacitly in the form of practices. The farmers attributed great value to the nutrient maps because these maps enabled to connect researcher output to the farmers' needs, which is crucial to realize implementation of research results in farming practice (Hazard *et al.*, 2017). This process of farmers providing tacit and explicit knowledge to researchers, and researchers translating it into easy to share conceptual explicit knowledge, reflects the externalization process as referred to in section 5.2 (Nonaka and Takeuchi, 1995;

Hoffmann, Probst and Christinck, 2007). As discussed in the results section, the absence of such an externalization process in the Flemish CoP, was regretted by the farmers. Within our cases, activities related to FDPs and on-farm research fostered this knowledge creation process, because both enabled profound exchanges between researchers, advisors and farmers and addressed individual farm management questions. The pilot farmer meetings in Flanders, aiming to provide technical knowledge to farmers, were hardly valued on this account, as knowledge shared and created during these meetings often stayed rather theoretical or general and led only to a limited extent to knowledge directly applicable on their farm.

The second process (lower triangle in Figure 2), is based on the knowledge sharing between the pilot farmers in group processes. The attendance of an advisor supported the translation of this knowledge towards more explicit practical knowledge, facilitating in-depth discussion between pilot farmers. Similar to Sumane *et al*. (2017), we found that sharing such practical and experiential knowledge gives farmers the confidence and capacity to apply new practices and to diffuse innovations. Activities fostering this process all involved peer-to-peer farmer interactions, preferably on farms, e.g. during farmer meetings and farm visits. This process of farmers exchanging knowledge through life experiences and discussions, reflects the socialization process as referred to in section 5.2 (Nonaka and Takeuchi, 1995; Wenger, McDermott and Snyder, 2002; Hoffmann, Probst and Christinck, 2007). The strong focus on such group activities in Flanders, contributed to community building and mutual trust and engagement between the pilot farmers. These are essential for an effective knowledge structure (Wenger *et al*., 2002), and allowed good pilot farmer discussions. The exposure to many different ideas broadened the pilot farmers' perspective on farm management and sustainability. In contrast, the limited group activities for the Northern Irish pilot farmers made that they only started to function as an open discussion group towards the end of the project.

Although our research, through the case of DAIRYMAN, provides inspiration on how tacit knowledge can be shared through different types of interactions, further research is needed to establish a comprehensive list of tools and activities that can support these interactions for knowledge creation with farmers.

5.6 Conclusions

DAIRYMAN was an important knowledge creation project for both researchers and farmers, and was based on the key working principles of CoPs. Using concepts of the CoP theory (domain, community, practice) and the value creation framework (VCF) developed by Wenger *et al*. (2011), we were able to specify CoP features that were valued by farmers

while participating in two regional networks of the DAIRYMAN project. The empirical work on the two cases allowed us to contribute to the understanding of designing knowledge creation in CoPs for sustainable agricultural development. First, regarding domain development, we suggest a conscious consideration of the domain taking into account project duration. Second, regarding community development, we found that the advisors should be given a central role, provided that they have skills as translators between researchers and farmers. Further, also other actors in the community also require specific competencies; e.g. farmers should have an open attitude, and researchers should have (practical) expertise in the CoP domain. Third, regarding practice development or the actual knowledge creation, we found two equally important types of interactions that contribute differently to value creation in CoPs: individual farmer-researcher-advisor interactions and farmer group- advisor interactions. Although our research provides valuable information in designing knowledge co-creation initiatives, further research is needed on the competencies and activities required to foster the two types of interactions of knowledge creation.

5.7 Acknowledgements

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CHAPTER 6.

Learning from the developmental history of sustainable farming initiatives

This Chapter addresses *R.Q. 2.3. Which organizational dynamics contribute to the development of an established SFI?* In this Chapter, we use the perspective of Cultural-historical activity theory to gain insights on the development and learning at the organizational level of the SFI. We thus take a systems perspective on the SFI as entry point of the research in this Chapter.

6.1 Introduction

A wide variety in public and private initiatives aim to support farmers in the sustainable development of their farming practices (Röling and Wagemakers, 1998; Cerf *et al.*, 2000; Blackmore *et al.*, 2012; Luederitz *et al.*, 2016; Koopmans *et al.*, 2017). Sustainable farming initiatives (SFI's) are social constructs in which multiple actors collaborate to support on-farm sustainable development. Such a collaboration induces a social learning process, in which SFI participants and organizers are involved to interactively share their knowledge, to produce new knowledge and trust, and to form the basis for joint action (Pahl-Wostl, 2006; Beers, Mierlo and Hoes, 2016). Despite their similar focus, SFIs show considerable variation in their success to support on-farm sustainable development. Some SFIs develop themselves towards an established initiative with enduring dynamical interactions, whilst others lack these dynamics and encounter difficulties to transcend the start-up phase.

Multiple scholars stress the dynamical character of collaborations and therefore argue that their outcomes can only be understood by taking into account these dynamics (Kilelu *et al*., 2013; Moschitz *et al*., 2015). For example, processes of interaction between different types of actors can influence their outcomes (Beers, Mierlo and Hoes, 2016; De Vente *et al.*, 2016) and internal and external factors of an initiative can induce both positive

or negative interaction cycles between actors involved (Klerkx, Aarts and Leeuwis, 2010). So, to understand the activities performed in SFIs, the problems they encounter in realizing these activities and the possible solutions to these problems, we need to examine the SFI's historical development (Virkkunen and Kuutti, 1999). Also in other fields, authors focused on the developmental history of initiatives to understand their state or impact at a given moment in time. For example, both situated in sustainability transition literature, Bui *et al*. (2016) studied the trajectories of four initiatives of alternative food networks to understand their impact on the agri-food regime, and Hermans *et al*. (2016) studied the innovation pathways of a grassroots innovation movement.

In this Chapter, we use principles from the Cultural-Historical Activity Theory (CHAT; Engeström, 1987; Engeström, 2009; Engeström and Sannino, 2010) to understand the developmental history of SFIs, i.e. the way they created relationships, roles and responsibilities (Biesta, 2009), new working processes and tools during their existence. CHAT's focus of analysis are collective activity systems in which activity is motivated by a collective, societal motive or object (Engeström, 2009; Vänninen, 2012), e.g. in our case the support of on-farm sustainable development. Interestingly, besides merely focussing on the interactions between the actors involved in the activity system, CHAT also explicitly gives attention to the mediating role of tools and cultural artefacts in the activity system. Further, CHAT views contradictions or frictions within and between the elements of the activity systems as main sources for internal change, and thus development. When practitioners of the activity succeed in creating and realising a potential path to overcome these contradictions ("zone of proximal development"), the activity system transforms towards a new developmental stage with a wider horizon of opportunities. This process is referred to as expansive learning (Engeström, 2001), because the participants of the activity system collectively engage in a learning process by creating and sharing knowledge through reflection on the activity system which results in the creation of new modes of practice that was not yet there at the outset (Seppänen, 2004; Hill *et al.*, 2007). These principles thus give an important role to the activity system's participants in the development and transformation of their activity (Restrepo *et al.*, 2014).

Our aim is to contribute to research on SFI development and to find underlying causes for the difference in success. We define success as the ability of an initiative to develop into an established SFI, that is durable and recognized for being an SFI. In doing so, we apply CHAT to understand the differences in success between two SFIs, Veldleeuwerik (The Netherlands) and Beloftevol Boeren (Flanders). By defining these SFIs as activity systems, and recognizing contradictions as forces for development, two specific research questions arise. First, which internal contradictions occur in the SFI development

and how do SFIs tackle them? Second, how does an SFI's ability to overcome the contradictions contribute to its expansion and its growing ability to support on-farm sustainable development? Answering these questions should enable us to define some factors that affect expansive learning within an SFI.

In following section 6.2, we describe the concepts of CHAT needed for the analysis, e.g. activity system, contradictions, zone of proximal development and expansive learning. The actual methodology to answer our research questions is described in section 6.3. In section 6.4, we describe our cases as activity systems. In section 6.5, we answer the first research question by presenting crucial contradictions in the cases' development and describe the ways they tried to tackle these contradictions. In section 6.6, we answer our second research question by discussing our cases' success or failure to expand as an SFI. In section 6.7, we try to come to general conclusions on factors that affect expansive learning. In section 6.8, we conclude.

6.2 CHAT as analytical framework

To investigate dynamics in the developmental history of SFIs, Engeström's Cultural-Historical Activity Theory (CHAT) offers the following concepts: activity system, contradictions, zone of proximal development and expansive learning. CHAT has been widely used in practice and research, and proved its value particularly in the analysis of learning in not-traditional, hybrid and multi- organizational settings (Engeström and Sannino, 2010, p. 2). Some studies have already been performed in an agricultural context, but most of them used the theory in interventionist research (Seppänen, 2004; Hill *et al.*, 2007; Mukute, 2009; Mukute and Lotz-Sisitka, 2012; Vänninen, Pereira-Querol and Engeström, 2015), rather than for the analytical purpose (Pereira-Querol, 2011) we aim for in this research.

The first concept, activity system, is the theory's basic unit of analysis (Figure 6-1). An activity system is a social construct in which actions of individuals are part of a collective activity that is motivated by a specific objective, e.g. support on-farm sustainable development. According to CHAT, an activity system is defined by six elements: object, subject, tools/artifacts, rules, community, division of labour. The model relies on the principle of mediation and is constituted in a way that each analytical element performs a specific mediating function between two other elements of the activity system (Nicolini, 2012). The object is the driving force and thus the motivation for activity. The activity is mediated by cultural artifacts or tools that are created by people to control their activity (e.g. sustainability assessment tools, farmer discussion groups, expert presentations) (Engeström, 2009; Vänninen, 2012). The subject is the actor who's perspective is used for

the analysis (Pereira-Querol and Seppänen, 2009). The interactions between the subject and the other actors involved in the activity (the community) are regulated by rules and the division of labour (Seppänen, 2002; Engeström, 2009; Vänninen, 2012). Activity systems can meet and interact with other activity systems to form a new collectively meaningful object (Engeström, 2009).

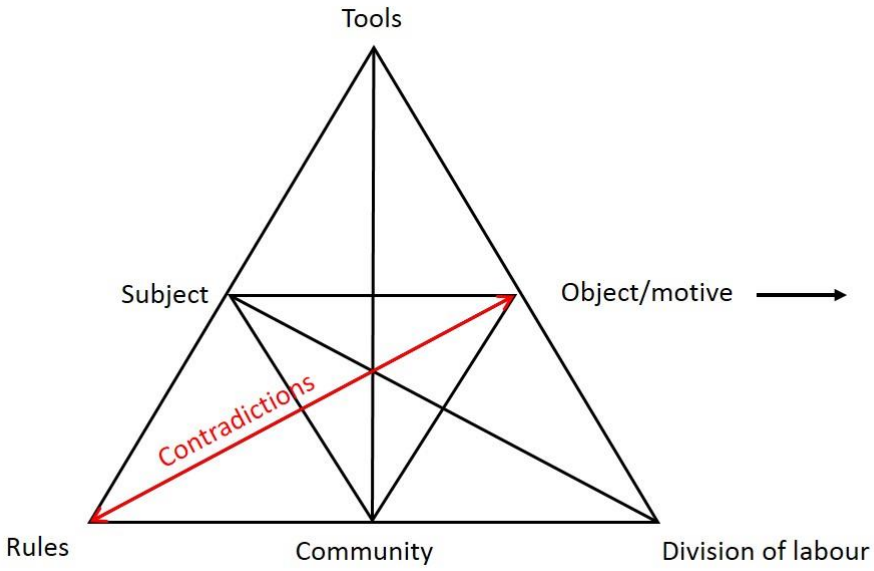

Figure 6-1. The structure of an activity system as developed by Engeström (1987)

The second concept, contradictions within and between the elements of the activity systems, are the activity system' driving forces for change, development and transformation (Miedema, 2008; Engeström, 2009). These contradictions must be seen as "*historically accumulating structural tensions within and between activity systems (…)* [which] *can generate disturbances and conflicts or innovative attempts to change the activity"* (Engeström, 2009). Engeström (1987) defines 4 types of contradictions. First, primary contradictions are the basic contradictions pervading all elements of the activity system (Miedema, 2008), e.g. conflicting rules within the system. Second, secondary contradictions, occur between elements of the activity system. This happens, for example, when new elements are adopted by the activity system and coincide with old elements; e.g., a new actor joins the activity system and causes conflicts in the existing divisions of labour. Third, tertiary contradictions, take place when the object of a more advanced form of the activity system is introduced into the old activity system, e.g., when the new object of the activity system requires new mediating tools. Fourth, quaternary contradictions occur when the central activity system is brought into relation with neighbouring activity systems. Activity systems develop and transform during longer periods of time. Therefore, to understand an

SFI's current problems and future potentials, it is necessary to recognize its history of tackling previous contradictions, i.e. scrutinizing its developmental history.

The third concept, "zone of proximal development" (ZPD) is closely linked to the concept of expansive learning. The particularity of expansive learning is that it "*is not a predetermined course of one-dimensional development*" (Seppänen, 2004), because what will be learned is not yet known at the start, or, as Engeström and Sannino (2010) state "*learners learn something that is not yet there"*. This learning what is not yet there is conceptualized in the ZPD concept, which includes the possible directions for solving the existing contradictions within the activity system (Seppänen, 2004). Engeström (1987) defines the ZPD as *"the distance between the present everyday actions of the individuals and the historically new form of the societal activity that can be collectively generated as a solution to the [secondary contradictions] potentially embedded in the everyday actions"*. In other words, the potential solutions for dealing with contradictions are inherent to the activity system itself and can be produced collectively by the actors involved in it (e.g., the creation of new tools, a new object and new social relations) (Engeström, 2009; Pereira-Querol, 2011). Eventually, the way an activity system decides to deal with the contradictions, reveals what needs to be learned to reach the future state of the activity system (Engeström, 1987). This evolution of an activity system is described as a *"journey through the zone of proximal development of an activity"* (Engeström, 2009). When the actions taken to solve the contradictions result in a reconceptualization of the activity's object and motive, and thus creates a wider horizon of possibilities, expansive transformation and thus learning of the activity system occurred (Engeström, 2009). In this way, contradictions can become actual driving forces of expansive learning (Engeström and Sannino, 2010, p. 2). *However, "an expansive learning process can involve smaller learning cycles within the actions, resulting in partial solutions (Engeström, 1996)"* (Vänninen, 2012). Moreover, expansive learning influences the whole activity system, because when the object of the activity system changes, the other elements of the activity system must be realigned accordingly (Vänninen, 2012).

In our research, we describe our cases in terms of activity systems, and use the concepts of contradictions, movement through the zone of proximal development and expansive learning to scrutinize their developmental history.

6.3 Methods

6.3.1 Cases

We chose two cases, one SFI in Flanders and one in The Netherlands, based on the difference in developmental dynamics, despite seemingly similar characteristics, such as the tools used to support on-farm sustainability. The first case is the Flemish initiative Beloftevol Boeren (BB), which can be translated as 'Promising Farming'. It aimed at on-farm sustainable development in the province of West-Flanders (Belgium) using an ISO14001 method. It was coordinated by a Flemish agricultural research institute, and started as part of an Interreg project (DuragrISO, 2009– 2012) that involved the regions of Picardie (France), Wallonia and Flanders (Belgium). The second case is Veldleeuwerik (VL) (which can be translated as 'Skylark'). It is a dynamic Dutch foundation that started in 2002 as a collaboration between 10 arable farmers, a brewery and an intermediary firm to define sustainable barley. Nowadays, the initiative counts ca. 400 farmers, 60 chain actors and 25 advisory services involved in the support of on-farm sustainable development and setting up sustainable product chains. The description of the activity system in section 6.4 provides further information..

6.3.2 Data collection

Data were collected from interviews, field notes and document analysis in different ways. The interview guides are added in Annex 3. First, 17 interviews (12 for VL, 5 for BB) were performed between July 2013 and May 2015 with different types of actors involved in both cases (the same interviewee can be attributed to different actor types): initiators (2 from VL, 1 from BB), organizing members (5 from VL, 1 from BB), farmers (6 from VL, 4 from BB), chain actors (1 from VL), advisors (2 from VL). Our interview guide comprised questions on three predefined different developmental activities, as we thought they would structure the interview: the foundation of the SFI, development of the processes and tools supporting on-farm sustainable development, and implementation of these processes and tools. These activities are not yet related to our analysis of the developmental history, but rather pragmatically chosen to ease the structuration of the interview. Questions on each process were guided by the activity system elements as described in section 2. Each interview ended with reflective questions on sustainability and learning in the SFI. All interviews were transcribed and coded in Nvivo 11 (QSR International). Second, field notes from 13 VL (05/2014-06/2015) and 1 BB (2/2013) farmer meeting, 1 VL conference (06/2017), and 7 telephone calls with the initiator of BB (08/2012-09/2017) were used to gain a more thorough understanding of the SFI's activities and dynamics. Third, available documents

(newsletters, official publications, reports, website, …) on both cases were used to support our findings (fact checking important dates, officially claimed goals, and actions taken) or to follow up new developments within the initiatives.

6.3.3 Data analysis

Our analytical process is schematized in Figure 6-2. All data were qualitatively analysed and for each predetermined developmental activity as questioned in the interview (SFI foundation, practice and tool development, and practice and tool implementation) codes were assigned to following coding categories: the six activity system elements, contradictions, respondent reflections, and timeline. Based on the retrieved codes, we reconstructed the cases' developmental histories with, if relevant, their subsequent developmental phases as defined by CHAT, i.e. when a new object was defined. First, we defined the main contradictions within the subsequent phases of activity systems (see 4.1). Second, we described how the cases, each in their own way, tackled these contradictions in their pursuit to solve them. Dependent on the case, this tackling process resulted either in problem solving and thus changes (expansion) in the activity system or in an impasse, i.e. the inability to solve the problem despite several attempts, which thus resulted in a stagnation of a situation. By reflecting on the developmental histories and the (possible) solutions our cases applied to solve the contradictions, we were able to define the possible directions in which activity systems can expand and thus require learning. We defined the possible directions as ZPD elements, that we further on clustered into ZPD dimensions. The definition of these elements and dimensions allow us to reconstruct the developmental path of the SFIs through the ZPD. These elements and dimensions are the outcomes of this research, and are compared with findings in literature. Finally, we will use these results to reflect on the implications for the expansive learning of SFIs.

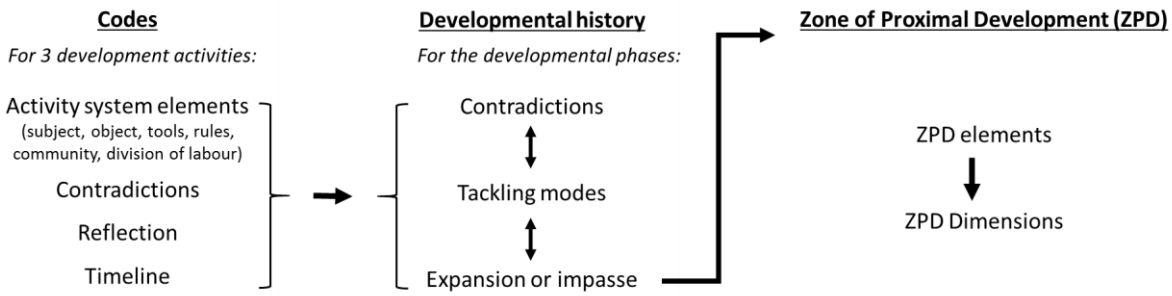

Figure 6-2. Analytical process: starting from codes, used to reconstruct the cases' developmental history, which enabled us to define elements and dimensions of the ZPD.

6.4 Our cases as activity systems

It this section, we show how we used the concept of activity systems to analyse and reconstruct the developmental history of our cases. In Table 6-1 and Table 6-2, the cases are described according to the six activity system elements defined by Engeström (1987) (see section 6.2). According to Engeström's theory, we defined a new phase when expansive learning had occurred, i.e. when a new object was defined and realigned in the cases' activity systems.

6.4.1 Beloftevol Boeren as activity system

The description of Beloftevol Boeren (BB) as an activity system is presented in Table 6-1. The aim of BB was to implement an ISO14001-method, that was developed in cooperation with French arable farmers before the project started, in West-Flanders. Eight Flemish farmers were willing to participate in an educational trajectory leading towards ISO14001 certification. During the period from 2009 to 2012, it functioned as part of the Interreg Project DuragrISO. When the Interreg project ended, the Province partly funded BB for another 1,5 years, to allow the participating farmers to finish the certification trajectory and to find new (stable) funding. During this period, the initiative never really succeeded in viably expanding its participants, activities and tool implementation. In its most successful period about 10 farmers were involved.

6.4.2 Veldleeuwerik as an activity system

The description and development of Veldleeuwerik (VL) as an activity system is presented in Table 6-2. VL started in 2002 and its subsequent development can be expressed in four developmental phases. However, the change in the elements between these phases should not be interpreted as sudden changes from one day to another, but rather as sometimes smooth, gradual processes in which the elements adjust to the new object. The first phase started with a project (2002) in which a brewery, 10 arable farmers and an intermediary firm closely collaborated to define sustainable barley. The second phase coincided with the expanded object of the project (2003-2004) in which an approach for on-farm sustainable development for arable farmers was drafted (involving the whole on-farm crop rotation system instead of merely barley). The third phase started with the founding of the Foundation Veldleeuwerik (2006), in which the developed approach for on-farm sustainable development was tested and further fine-tuned with 45 farmers, 5 chain actors and the intermediary firm. This phase was accompanied with multiple discussions on how to organize the foundation and its sustainability system. The fourth phase (2011) coincided with a substantial growth in participants (ca. 400 farmers, 25 chain partners and 15 advisory

firms), that resulted in measures to better organize and maintain the quality of its activities . At the time of writing, VL's aim is to establish on-farm sustainable development and to facilitate sustainable arable food chains, by means of knowledge exchange between farmers and between farmers and chain partners. The basis for on-farm sustainable development is the use of farm sustainability plans and regional farming groups. At a VL Conference held in 2017, discussions arose about VL's vision on the role it wants to play in society and the ways this should be accomplished (e.g. if and how to measure sustainable development). This might announce a new development phase, however, it is too early to state this.

Table 6-1. Description of Beloftevol Boeren based on the six elements of an activity system (Engeström, 1987)

Activity system element	Description Beloftevol Boeren
Subject	Farmers from first and second project cycle Coordinator and facilitator of the initiative Coordinator of the research institute
Object	Improve on-farm sustainability in the province of West –Flanders, by implementing an ISO14001 system.
Tools	ISO14001 system co-developed by French farmers, including tools for environmental risk assessment, legislation compliance check on the farms, drafting an action plan Educational trajectory for participating farmers to become certified, including documentation system, group coaching program (10 meetings on various sustainability themes), internal and external audits. Online platforms Duragr'iso foundation to certify Belgian Farmers
Community	8 (Interreg)+ 6 (post-Interreg) farmers from different industries (arable farmers, dairy farmers, fruit growers, ...) Facilitator of the Flemish initiative Interreg project partners of other regions Province of West-Flanders
Rules	3 year Interreg funding 1,5 year province funding Rules attributed to food production activities: Farmers (products) have to comply with multiple specifications and complex legislations, and thus perceive high work pressure Flemish farms deal with economic crisis due to low product prices and competition
Division of Labour	Interregional project partners develop tools for the project. Flemish facilitator is Flemish representative in the Interreg project Flemish facilitator organizes and coaches the educational trajectory for Flemish farmers Province of West-Flanders funds project after Interreg ended.

Table 6-2.Description of Veldleeuwerik based on the six elements of an activity system (Engeström, 1987), in 4 subsequent developmental phases.

Activity system element	Phase 1: Sustainable Barley	A →	Phase 2: Whole farm approach	B →	Phase 3: Foundation Skylark	C →	Phase 4: Formalization
Subject	Project participants (10 farmers, brewery and intermediary firm)		Project participants (10 farmers, brewery and intermediary firm)		Foundation Skylark		Foundation Skylark
Object	Define sustainably produced barley and produce it accordingly		Develop a system for on-farm sustainable development of arable farming practices		Implement system to achieve continuous sustainable development on farms		Expand system on arable farms throughout The Netherlands, build sustainable supply chains and restore context between farmers and consumers.
Tools	Dialogue and knowledge exchange between farmers, the intermediary firm and brewery Farmer discussion groups with expert involvement on soil and sustainable agriculture		joint system development involving farmers, intermediary firm, brewery and research institutes Farmer discussion groups		Foundation: “Stichting Veldleeuwerik”. Farm development plan with 10 sustainability indicators Sustainability assessment tools Farmer discussion groups		Farm development plan with 10 sustainability indicators Sustainability assessment tools Farmer discussion groups Knowledge workshops for farmers Participation board Advisor accreditation program System certification Online farmer sustainability profile ”Reward” farmers for participation Upscaling knowledge exchange
Community	10 arable farmers Intermediary firm Brewery Experts from research institutes Project facilitator		10 arable farmers Intermediary firm Brewery Experts from research institutes Project facilitator		45 arable farmers Intermediary firm 5 agro-food chain partners (product buyers) Farm advisors Foundation board		Ca. 400 arable farmers 25 agro-food chain partners 15 advisory firms Foundation, advisory and quality board 6 employees in daily management group
Rules	Farmers are willing and open in their communication towards the brewery Farmers grow more than only barley		Farmers are willing and open in their communication towards the brewery		Farmers and chain partners contribute financially to the foundation Farm advisors are not compensated for their advisory work Intermediary firm merges with other firm		Participation rules for farmer Consumers are willing to pay for sustainable products
Division of Labour	Brewery finances the project and project facilitator Experts educate farmers on sustainable agriculture and soil knowledge Intermediary firm facilitates contact between Brewery and farmers		Funding from EU, Province and brewery Research institutes experienced in (agricultural) sustainability facilitated joint system development Intermediary firm facilitates contact between Brewery and farmers		Advisor of the intermediary firm facilitates farmer discussion group Arable farmers participate in discussion groups and take sustainability actions on their farms Farmers, chain partners, advisors are represented in the foundation board		Accredited Farm advisors from advisory partners provide guidance in the farmer discussion group and make farm sustainability plans. Arable farmers participate in discussion groups and take sustainable actions on their farms. Chain partners organise workshops for farmers.

6.5 Contradictions and the way our cases dealt with them.

Our analysis allows us to define the crucial contradictions that contributed to the cases' development. Table 6-3 and Table 6-4 summarize between which activity system elements contradictions took place, the contradiction type (secondary (II) or tertiary (III)), its description, how the cases tried to tackle the contradiction, and how this contributed to the development of the SFI. The descriptions of the contradictions in both tables are numbered for easy referencing. Where possible, they are chronologically represented according to their occurrence in time (e.g., as reflected in the different VL phases). However, similar to our cases' descriptions and their developmental phases, these contradictions should not be interpreted as strictly sequential, but rather as processes that might have occurred simultaneously.

For BB, no tertiary contradictions took place (i.e. occurring between the object of an advanced form of the activity system and elements of the old activity system), as during its developmental history no new object was formulated. For VL, both secondary (between elements of the activity system) and tertiary contradictions were crucial in its development. Secondary contradictions led to the formulation of new objects for the activity system and thus introduced a new phase in VL's developmental history (Table 6-2). Although tertiary contradictions could be interpreted as naturally occurring, because these elements had to be realigned with the new object, our analysis shows that they can have a major influence on future developments and expansion of the SFI. We elaborate on both tables in 1.1.1 and 6.5.2.

Table 6-3. BB's main contradictions, the way BB tried to tackle them, and how it contributed to BB's development.

Main contradictions	Type	Description	Tackling contradictions	Contribution to case development (E: expansion or I: impasse)
Community vs. Tools	II	BB1. Community with limited number of farmers contradicted with group-based tools	- Attempt to attract extra farmers (failed) - Attempt to recognize BB in the CAP greening measures (failed)	- I: number of participants - I: spatial spread - E: interpretation of the intended target group
		BB2. Community, including all participating farmers, contradicted with the ISO14001 tool certifying only the better performing farmers.	- Not tackled	- I: number of participants
Tools vs. Rules	II	BB3. Tools, inflicting additional work load, contradicted with the high work pressure of farmers	- Founding of foundation for certifying farmers as group - Attempt to use a "lean" version of the ISO14001 method	- E: formalization - I: number of participants - I: spatial spread
		BB4. The tools, with certification and group coaching, contradicted with the rule of farmers producing for the market.	- Use of ISO14001 tool was out of question because of embedding in Interreg project - Attempt to find support from market actors (failed)	- I: number of participants - I: spatial spread - I: stakeholder involvement
		BB5. Tools "imported" from France contradicted with the Flemish sociocultural, legislative, and market rules.	- Translation of the legislation check resulted in a complex tool.	- I: formalization
Object vs. Division of labour	II	BB6. The object to improve on-farm sustainability contradicted with the Flemish facilitator's more comprehensive tasks	- Employment of extra work force, but difficult to legitimize	- I: formalization
Community vs Division of labour	II	BB7. Community lacking suitable funding actors, conflicted with division of labour when financing bodies stopped.	- Attempts to convince stakeholders to participate in a project	- I: stakeholder involvement - I: self-support
		BB8. Community including farmers but lacking relevant stakeholders contradicted with the division of labour, in which local farmers nor other stakeholders were involved in the tool development.	- Attempts to convince stakeholders to participate afterwards	- I: stakeholder involvement - I: number of participants - I: spatial spread

Table 6-4. VL's main contradictions, the way VL tried to tackle them, and how it contributed to VL development.

Main contradiction	Type	Description	Tackling contradictions	Contribution to case development (E: expansion or I: impasse)
Object vs. Rules (phase 1)	II	VL1. The object of defining sustainable barley contradicted with the rule of multiple crop plans .	- Farmers convinced VL actors to expand the subject of sustainable development from crop to farm level	- E: subject of sustainable development
Community vs Division of labour (phase 2)	II	VL2. The community lacking suitable funding contradicted with division of labour in changing VL funding .	- Set out Foundation Skylark and attract additional chain partners	- E: stakeholders involved - E: formalization of the organization - E: self-support
Object (phase 3) vs. community (phase 2)	III	VL3. The new object contradicted with the phase 2 community.	- The number of participating farmers was expanded to 45 across the province, due to the intermediary firm's connections. .	- E: participants - E: spatial spread
Community vs. tools (phase 3)	II	VL4. Growing community contradicted with the available tools to support farmers.	- Change from informal to formal participation rules	- E: formalization of rules
Object vs. Division of labour (phase 3)	II	VL5. The object to implement the VL method contradicted with organisational tasks. VL6. The object to implement the VL method contradicted with the advisors' task package	- Farmers threatened to leave VL. - The foundation board decided to put forward new objects focussing on growth, the development of sustainable agri-food chains, and to restore the context with society.	- E: subject of sustainable development
Object (phase 4) vs. Community (phase 3)	III	VL7. The new object to expand the initiative throughout The Netherlands contradicted with the phase 3 community	- People hired for operational work - Promised rewards for participating farmers	- E: participants - E: spatial spread - E: formalization of the organization - E: interpretation of the intended target group
		VL8. The new objective to restore social contact between producers and consumers, contradicted with the community lacking societal actors.	- Successful attempts to gain support from some farmer unions, new chain actors and advisory firms. - Creation of an advisory board	- E: stakeholder involvement
Community vs. Division of labour. (phase 4)	II	VL9. The community, expanded in terms of participants, contradicted with the division of labour in the daily management group	- The daily management group expanded to 4 full time equivalents - Regional coordinators were hired	- E: formalization of the organization

Main contradiction	Type	Description	Tackling contradictions	Contribution to case development (E: expansion or I: impasse)
Community vs Tools (phase 4)	II	VL10. The community, expanded in terms of participants, contradicted with available tools, no longer suited to guarantee a qualitative on-farm sustainable development	- Strict follow up of participation rules for farmers - Certification of the VL method - Development of new ways to guarantee knowledge exchange between the participating actors. - Automatic registration of the sustainability plan - Specifically designed training for accreditation of farm advisors	- E: formalization of rules - E: formalization of the organization - E: communication towards society
		VL11. The community, expanded in terms of opinions on the VL method, conflicted with the tools lacking hard measurement of actual on –farm progress.	- decision to link 10 major ambitions for future development to the sustainability profiles of its participants.	- E: communication towards society

6.5.1 Beloftevol Boeren

6.5.1.1 Contradictions between Community and Tools

We interpreted two issues as contradictions between the Community and the Tools of the activity system.

First, the community, with its rather limited number of farmers (ten at its maximum), contradicted with the tools, such as group meetings and expert involvement (BB1 in Table 6-3). This happened because of several reasons: (i) it limited the variety in perspectives in group meetings, (ii) it limited the number of farmers with similar production processes (e.g. arable farmers, dairy farmers, …), and (iii) it increased the distance between participating farms. Further, it caused difficulties to justify project costs, and thus it also limited the ability to invite interesting experts. BB tried to tackle this contradiction by making efforts to attract farmers. They used press announcements, organized information meetings and excursion day with testimonies of participating farmers, and personally contacted open-minded farmers known by the research institution. However, these efforts had a very limited success and resulted in an impasse regarding the expansion of the participant group and the spatial spreading of BB. Causes for this limited success to attract farmers are interpreted as contradictions between the tools and rules of the activity system (see 6.5.1.2).

Another kind of attempt to attract farmers was aimed at providing a “reward” for farmers who participated in BB. One of the participating farmers tried to convince the cabinet of the then minister of agriculture to recognize BB-participants as “green” farmers who can be offered exemptions for meeting the obligated greening measures of the new CAP. Although this attempt did not succeed, it shows that BB made expanded the proposed motivation of target participants, i.e., from merely autonomously motivated farmers towards also the inclusion of farmers who participate to obtain a reward or other benefits. This can be interpreted as an expanded interpretation of the intended target group.

Second, the community, including all participating farmers, contradicted with the ISO14001 certification tool. Indeed, only the participating farmers who performed better on the ISO14001 prescriptions were considered eligible for certification (BB2 in Table 6-3). This might have caused a loss in motivation of the non-qualified farmers to keep on participating in BB, which further caused a decline in the number of farmers. Overall, farmers who left BB, stated that their participation did not deliver sufficient added value to them. The embedding of BB in the Interreg-project prevented to address these contradictions related to the ISO14001-tool, because the use of the ISO14001-tool was predetermined through the Interreg-project. This basically left the use and adjustment of

this tool out of question, and thus also contributed to the impasse in the number of participants.

6.5.1.2 Contradictions between Tools and Rules

We interpreted three main issues as contradictions between the tools used by BB and the rules related to farmers being embedded in a (local) food production context.

First (BB3 in Table 6-3), the ISO14001-tool inflicted work for the farmers' additional to their daily work. This contradicted with the general rule of Flemish farmers facing hard times economically (e.g., due to low product prices) and high work pressure (because of the economically hard times, the multiple specifications of product buyers and a complex legislation) (BB3 in Table 6-3). For the ISO14001-tool, farmers had to keep an administration of records and forms up to date for internal and external audits. To lower additional administrative paper work (and costs) related to the ISO14001-certification, BB decided to set up a foundation together with the Walloon Interreg project partners to certify the group of farmers as a whole instead of each farmer individually. This resulted in clear rules and role divisions that contributed to the formalization of BB. However, irrespective of the certification process, the ISO14001-tool was not further taken into account for adjustment within the BB activity system. The Flemish facilitator did try to use a "lean" version of the ISO14001-method in another project, but was not successful as it made the tool meaningless and not fit for purpose. This made them realize that the method was only useful for farmers willing to engage in an ISO14001 process. It also further contributed to an impasse in the number of participants and the spatial spread of BB.

Second (BB4 in Table 6-3), the tools, such as ISO14001 and the group coaching program, contradicted with the rule of farmers producing for the market. Both tools were not required for market access, nor were recognized by important market actors. As participation in BB thus did not deliver added market value for the farmers, some farmers perceived the additional paper work as a burden and it repelled potential farmers from participating. According to a participating farmer, using ISO14001 as a market-specific tool was hampered by its general approach (i.e., not production specific), fit for a diversity of farms (e.g. arable farmers, dairy farmers, …). To deal with the lack of support from market actors, the Flemish facilitator sought support from several firms of the food industry and a farmers' union. These efforts were unsuccessful, as they these actors did rather wanted to develop tools on their own or refused collaboration with one of their competitors in the project. All this contributed to an impasse in the number of farmer participants and the spatial spread, but also in the involvement of stakeholders.

Third (BB5 in Table 6-3), the tools, such as the legislation check, were “imported” from France through the Interreg-project. This caused contradictions with the Flemish sociocultural, legislative, and market rules the Flemish farmers adhered to. This made the tools’ use time consuming because it required a lot of coaching and facilitation of the Flemish facilitator. For example, the introduction of an interregional online platform aiming to relinquish some responsibilities to the farmers on this account, did not work out, as the tools were not fit to the Flemish context yet. BB tried to tackle this contradiction by translating tools to the Flemish context. However, the Flemish complex legislation seemed very difficult to translate in such a tool. This inhibited the automation of the legislation check, and thus also the ability for farmers to complete the legislation check autonomously. These contradictions contributed to an impasse in the formalization of BB.

6.5.1.3 Contradictions between Object and Divisions of labour

Contradictions between the object to support on-farm sustainable development in West-Flanders often contradicted with the tasks attributed to the Flemish facilitator (divisions of labour)(BB6 in Table 6-3). Being the only actor dealing with operational issues, she had to combine multiple responsibilities related to BB’s involvement in the Interreg-project and the organization of BB, for example, project administration, translation of documents and tools, or contribution to the development of new tools that were not yet relevant for Flemish farmers. These responsibilities influenced the time that could be spent on the actual implementation of the ISO14001 method and the on-farm sustainable development in Flanders. This contradiction enlarged when the Flemish facilitator started working on other projects when the BB funding ended. To tackle this, other persons were involved to, for example, support on-farm development and translate the legislation check. However, the low number of participating farmers made it difficult to legitimize big time investments. This further contributed to an impasse in the formalization of BB.

6.5.1.4 Contradictions between Community and Divisions of labour

We interpreted two main issues as contradictions between the community and the divisions of labour.

First, the lack of agri-food actors and other stakeholders involved in the community contradicted with BB’s funding (the division of labour)(BB7 in Table 6-3), as it proved difficult to find (financial) support after the funding bodies (Interreg and Province) stopped financing BB. BB tried to tackle this contradiction by searching for other funding opportunities. The Flemish facilitator unsuccessfully tried to find extra funding by searching stakeholders (food processers, food auctions, and farmer unions) to collaborate on a proposal for a project call, that included the ISO14001-approach of BB. Similar to BB4, the

contacted stakeholders refused cooperation in a project as they lacked a feeling of ownership about the tools used or refused collaboration with one of their competitors. The unsuccessful tackling of this contradiction contributed to an impasse in BB's stakeholder involvement and financial self-support, as it was not able to expand its community and create financial stability.

Second, the community, including farmers but lacking relevant stakeholders, contradicted with the division of labour, in which neither local farmers nor other stakeholders were involved in the tool development and goal setting of BB (BB8 in Table 6-3). This contradiction might be interpreted as an underlying contradiction for other contradictions, as it caused problems with the embeddedness of the BB tools in the local context (BB5) and the ability to attract stakeholders to support BB (BB4 and BB7). Based on this interpretation, this contradiction thus contributed to an impasse in the number of participants involved, in the spatial spread and the stakeholder involvement.

6.5.2 Veldleeuwerik

6.5.2.1 Phase 1: Contradictions giving shape to phase 2

In VL's first developmental phase (Table 6-2), the object of defining sustainable barley contradicted with the general rule of farmers having a cultivation plan with multiple crops (VL1 in Table 6-4). The focus on the production of sustainable barley was chosen by the funder of the project, i.e., a brewery, one of the major processors of barley. This contradiction became particularly apparent during tool development. To tackle this problem, the farmers convinced the brewery and the intermediary firm involved in VL to shift focus to the whole farm-level cultivation plan. This major shift was made possible by the close interactions and mutual trust between these actors during collective tool development. In VL's overall development, this contributed to an expansion of the subject of sustainable development, namely from crop level to farm level. This resulted in a new wider object and motive for the activity system, i.e., developing a method for on-farm sustainable development. This meant the start of developmental phase 2.

6.5.2.2 Phase 2: Contradictions giving shape to phase 3

In phase 2, a contradiction emerged between the community, that lacked sufficient suitable funding partners, and the division of labour, when its former temporal funding bodies (Provinces, EU and Brewery) stopped financing the activities (VL2 in Table 6-4). To tackle this contradiction, four new, financing, chain partners were attracted. Old and new actors regulated their role and relationships by setting up the foundation "Stichting Veldleeuwerik". The creation of the foundation led again to a new object and motive, i.e., to

test and implement approach for on-farm sustainable development that was jointly developed during phase 2. In the foundation, new roles were attributed to new and old participants, e.g., through the creation of a foundation board. For participation in the VL foundation, all actor types (including farmers) had to contribute financially according to their firm size. This created equal decision making positions between actors in the foundation board, which proved of value when the number of participants grew. Tackling this contradiction greatly influenced the overall development of VL, as it expanded the number of stakeholders involved (by attracting more chain partners), the degree of formalization (by setting up a foundation), and the degree of self-support (by becoming self-maintained).

Subsequently, this newly set object, to test and implement the developed VL approach for on-farm sustainable development, conflicted with the community residing from phase 2 (VL3 in Table 6-4). In phase 2, all farmers involved in VL were also involved in the development of the VL approach. So, to test and implement this approach, other farmers had to be attracted. To do so, the intermediary firm used his connections with other farmers and chain partners, to expand the number of participating farmers to 45 across the province. This contributed to VL's first expansion in the number of participants and spatial spread.

6.5.2.3 Phase 3: Contradictions giving shape to phase 4

In phase 3, the growing community of farmers and chain partners caused a contradiction with the tools that were deemed not suitable to qualitatively support the growing number of participants (VL4 in Table 6-4). To deal with this issue, the participation rules changed from rather informal interactions between the involved actors towards more formal participation rules for farmers and by assigning advisors and farmers to specific farmer groups. So, dealing with this contradiction contributed to an increased level of formalization (clearly defined role divisions for farmers and advisors, and participation rules for farmers).

Later in phase 3, two issues emerged as contradictions between the object and division of labour. Both were simultaneously tackled in the same way. First, the object of phase 3 to implement the VL approach for on-farm sustainable development contradicted with the task package of some foundation board's members. They put a lot of time and effort in negotiating about the goals and organization of the foundation at the expense of actual implementation of the VL approach (VL5 in Table 6-4). Second, the object also started to contradict with the task package of the farm advisors, who facilitated the on-farm sustainable development (VL6 in Table 6-4). This happened after their firm merged with another firm, that lowered priority for time investment in VL. This highly influenced the advisors' motivation to perform their tasks for VL. Both contradictions resulted in diminished available time to actually support the participating farmers in on-farm sustainable

development and diminished the activity (with farmers) in the field. This reduced activity in the field frustrated the farmers, and they threatened to leave VL if this situation would not change. This wake-up call urged the foundation board to change its ambitions, by focussing on growth ("VL will be the most important method for arable farming in 2015"), the development of sustainable agri-food chains, and restoring the context between farmers and society. This changed object and motive meant the start of developmental phase 4 (Table 6-2) and it coincided with an expanded meaning of the subject of sustainability, i.e., although the focus on on-farm sustainable development was still key, the newly set object expanded this focus towards also setting up sustainable product chains.

Subsequently to the formulation of this new object, two new issues emerged, that we interpreted as contradictions between the newly set object of phase 4 and the community of phase 3. First, VL's newly set goal to grow contradicted with the community residing from phase 3, in which the necessary actors to achieve VL's goals were not present yet (VL7 in Table 6-4). To tackle this, the foundation board assigned two paid people with the daily management tasks to operationalize the objectives. This contributed to VL's increased formalization. Further, several actions were taken to attract new farmers. For example, a financial stimulus was provided by an associated chain partner for sugar beets produced by VL farmers, VL farmers were given specific exemptions to meet the CAP regulations, and the development of a product label was proposed. This reflects an expansion in focus on merely farmers that are autonomously motivated to participate at the beginning, towards also attracting farmers who are motivated to participate because of these benefits. Both the efforts performed by the hired people for daily management tasks and the actions performed to attract new farmers, resulted in VL's quick growth since 2011. They reached an number of ca. 400 participating farmers in 2017, spread over the Netherlands. However, this growing number of people also induced contradicting visions on the future of Skylark within the community (primary contradiction). Some of the participating farmers wanted the initiative to stay small to guard quality of the process and to be able to distinguish them from the "mainstream" farmers. Contrary, the chain actors wanted VL to grow, because it is commercially beneficial for them.

Second, the newly set object, including restoration of the social contact between farmers and society, contradicted with the community of phase 3 that still lacked these societal actors (VL8 in Table 6-4). As a response, VL managed to gain support from some farmers' unions, other chain partners (up to 60 in 2017), and commercial organizations offering advisory services that provided the farm advisors needed for VL activities (25 in 2017). Further, an advisory board was created aiming to provide VL with advice on societal issues. In the advisory board, several societal partners were involved, such as farmers'

unions, environmental organizations, education and science, and regional water authorities. This higher embedding in society and the agri-food system resulted in an expansion of the stakeholder involvement in VL.

6.5.2.4 Phase 4: Contradictions dealt with in phase 4

In phase 4, a contradiction arose between the strongly growing community and the divisions of labour within the group of people responsible for the daily management (VL9 in Table 6-4). As a response, the daily management group expanded to four full time equivalents and regional coordinators responsible for organizing farmer meetings were hired from other firms. This further expanded VL's degree of formalization.

Finally, two issues could be interpreted as contradictions between the strongly growing community and the tools. The first contradiction occurred between the expanded community and the available tools, that no longer guaranteed a qualitative on-farm sustainable development for such a big community (VL10 in Table 6-4). When the community was smaller it was easy to keep the overview of the farmers' engagement of in VL activities and progress made on their farms. This was no longer possible for the big community. To tackle this, multiple actions were undertaken. First, to ensure qualitative sustainable on-farm development, the participation rules for farmers were followed-up more strictly by a quality board, installed to act in case of disputes about the adherence to these rules by farmers. Second, to further guarantee transparency regarding the sustainable on-farm development towards chain partners and societal actors, the VL method for on-farm sustainable development was certified. This further increased the degree of formalization. Farmers in the foundation board wanted to keep administrative formalization as low as possible, so every introduction of increased formality was preceded by intense communication towards the participants to help them understand the necessity. Third, new procedures were developed to guarantee knowledge exchange between regional farmer groups across the country (e.g., through regional exchange visits, newsletters, cross regional projects), between farmers and chain partners (through knowledge workshops) and between participants, the foundation board and the daily management group (through the representation of multiple actors in several boards). Fourth, automatic registration of the sustainability plan by farmers was developed. This allowed to create so-called sustainability profiles, that give an overview of sustainability actions taken by farmers. Fifth, to ensure qualitative guidance of the farmers, a specifically designed training was set up for accreditation of involved farm advisors. All these actions contributed to a further formalization of VL. By introducing the sustainability profile of farmers, the opportunity to communicate towards society was also expanded.

The second contradiction arose between the expanded community, holding multiple actors' diverse visions, and the available tools, that were not able to respond to the request of chain partners and consumers to prove on-farm sustainable development, preferably in the form of hard figures (VL11 in Table 6-4). The growing number of opinions nourished the discussion on measuring on-farm progress. The initially involved farmers had a clear stance on measuring on-farm sustainable development, as they believed on-farm sustainable development is a matter of mentality change and awareness creation. Therefore, they were only interested in measuring progress if it would personally support farmers in their on-farm sustainable development. They claimed they were already bound to fill out check lists through legislation and specifications, and which they esteem as "worthless sustainability on paper". However, some newly joined actors and stakeholders favoured measuring on-farm progress to enable communication about progress made by VL farmers and VL's overall contribution to sustainable development in Dutch agriculture. Based on this discussion, the VL board decided to renew the certified VL method, and to link 10 major ambitions for future development to the sustainability profiles of its participants. This takes into account both the stance of some actors to hold minimal thresholds for farmers and the value farmers give to awareness creation and own farmer responsibility in sustainable development. At the time of writing, these ambitions are defined using a bottom-up approach, in which working groups of farmers and chain partners set out an approach, that will be fed back to the broader community during a working conference. Tackling this contradiction thus contributed to a changed meaning in how to communicate on their work towards society.

6.6 (Re-)constructing the zone of proximal development (ZPD)

Our analysis not only shows how contradictions took place within the activity systems of the cases, but also how the participants gained insights in the problems, and tried to find ways to overcome issues. This reflects the learning process the SFIs in finding solutions for the contradictions: the actions undertaken reflect outcomes of these collaborative learning processes. Comparison between both cases, however, shows that possible solutions for tackling contradictions are sought in multiple directions. These directions thus reflect elements of the Zone of Proximal Development (ZDP) of an SFI, i.e. the possible solutions for tackling contradictions within its activity system. However, the followed direction to solve these contradictions could either succeed or fail, which we interpreted either as an expansion or impasse in the cases' opportunities to develop. So, the attempts of our cases' community to tackle the occurring contradictions resulted either in an expansion, when the case succeeded in tackling a contradiction, or in an impasse, when the case recognized

possible solutions but did not manage to solve the contradiction. An impasse thus results from the activity system's inability to overcome the contradictions that take place within the activity system. For example, BB unsuccessfully undertook multiple attempts to involve chain actors in its community, which we interpreted as an impasse to develop stakeholder involvement.

We derived nine directions for tackling contradictions from our case analyses: number of participants, spatial spread, stakeholder involvement, self-support, subject of sustainable development, intended target group, communication towards society, participation rules and organizational formalization. We can consider them as elements of the ZDP because each of them contribute to a chosen direction of development, regardless of whether it led to expansion or impasse. Further, we were able to cluster the ZPD elements in three overarching ZPD dimensions, based on the type of expansion they induce: socio-spatial, meaning and institutional. Figure 6-3 and Figure 6-4 give an overview of these ZPD dimensions and their underlying ZPD elements and on how the specific directions of development caused an expansion or impasse for this case. The arrows show if expansion took place, the shaded boxes show impasses (i.e. the inability to expand, although the urge is felt), and the dotted boxes represent a neutral status without problems being perceived on this regard.

Figure 6-3 shows that BB hardly experienced expansion during its developmental history and faced a lot of impasses (which is also reflected in Table 6-3). VL, on the contrary, hardly faced enduring impasses and managed to turn contradictions into expansion of the cases' development. Figure 6-4 shows a gradual expansion for most factors and dimensions, except for stakeholder involvement that was already high from the start.

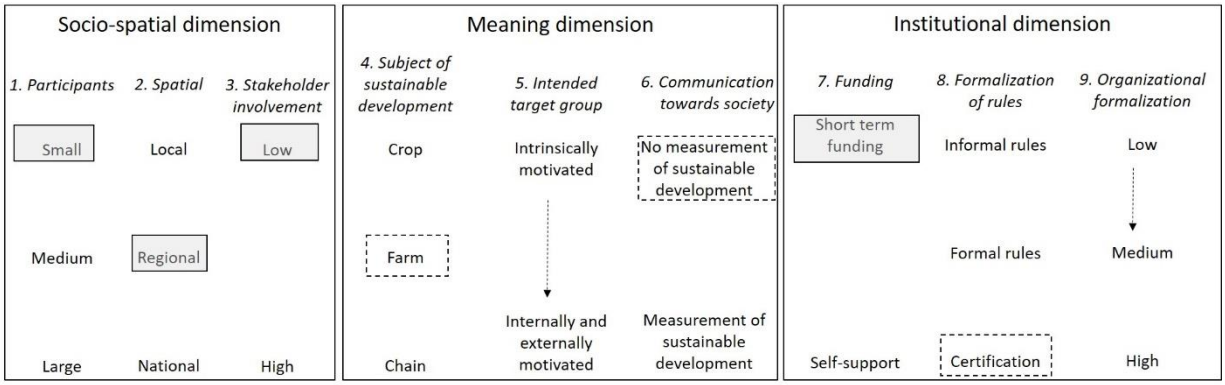

Figure 6-3. Developmental path in the ZPD dimensions' features of Beloftevol Boeren. (Inspired by Hermans, Roep, and Klerkx, 2016)

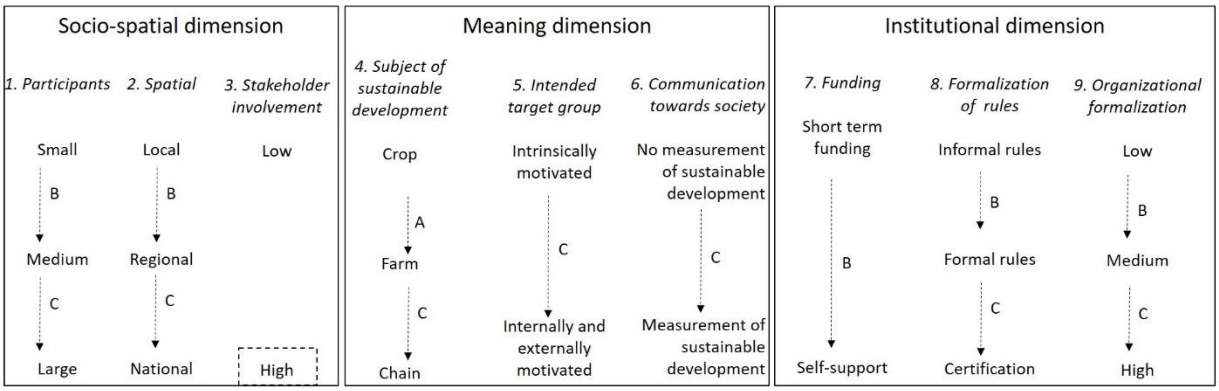

Figure 6-4. Developmental path in the ZPD dimensions' features of Veldleeuwerik. The letters beside the arrows refer to the developmental movements between the developmental history phases as described in Table 6-2. (Inspired by Hermans, Roep, and Klerkx, 2016).

The ZPD dimensions, derived from our analysis, resemble those of Pereira-Querol and Seppänen (2009) and Hermans *et al*. (2016). Pereira-Querol and Seppänen (2009) found a meaning, socio-spatial and formalization dimension in their research on the developmental history of an on-farm biogas production case in Brazil. Based on literature research, Hermans *et al*. (2016) defined an administrative, institutional, spatial, network and innovation scale for the upscaling and outscaling of grassroots innovations, which resemble our socio-spatial and institutional dimension. This shows that in literature, similar dimensions might be labelled differently, as their labels are guided by the specific processes researchers are interested in (Hermans *et al*., 2016). The ZPD elements and dimensions we present here, are those that emerged from the analysis of our cases' development. Possibly, more or other dimensions are at play in other cases. The ZPD dimensions and elements resulting from our research are discussed in the following subsections.

6.6.1 Socio-spatial dimension

In our cases, expansion in the socio-spatial dimension is influenced by the number of participants, the geographical distribution of the SFI, and the involvement of stakeholders. Regarding the number of participants, both cases started with a rather small number of ca. 10 farmers located in one province. Despite their efforts, BB never succeeded in significantly increasing this number because of participating farmers leaving BB and the inability to attract farmers, which finally made it difficult to legitimate expenses and efforts made to keep the SFI going. On the contrary, the development of VL was characterized by two major periods of growth, taking place after contradictions between newly set objectives and the community of the former developmental phase occurred. In particular in its early stages, the broad network of the intermediary firm's representative involved in VL played

an important role in expanding the community and bringing together farmers and chain actors. The important role of intermediaries, defined as "*organizations working between social interests* (Hansen and Coenen, 2015, p. 97)", to mobilize heterogeneous groups of actors, is also recognized by other scholars for example in research on sustainability transitions (Hodson and Marvin, 2010; Hansen and Coenen, 2015)

Regarding the spatial expansion, BB deliberately focussed on one province, because the organizations that funded and facilitated BB were related to this spatial level of the province, i.e., the Interreg-project included the region of West-Flanders, the subsequent funding was provided by the Province of Western-Flanders and the facilitation occurred by the provincial research institute. As it did not grow in terms of number of participants and did not succeed in finding other funders, a spatial expansion was also not obtained. VL, on the contrary, started very local in the province of Flevoland, expanded across the province during the first period of growth, and further expanded on national scale during the second period of growth, when farmers and chain partners from all provinces in The Netherlands started to participate (2C in Figure 6-4). Scholars have pointed the importance of place dependency in the development of sustainability transitions and environmental innovations, as it might influence the diffusion potential of developed innovations (Smith, 2007; Hansen and Coenen, 2015). This is exemplified by our BB case, as it seemed difficult to integrate the ISO14001-tool, developed in France, into Flemish practices.

Regarding stakeholder involvement, both cases differed already from their outset. At the outset of BB (during goal setting and tool development and choice), other Flemish stakeholders than the Flemish coordinator were not involved (Figure 6-3). This resulted in the use of an "imported" tool that did not fit Flemish social, cultural and legislative rules, but also in the inability to involve stakeholders afterwards as they lacked ownership. Klerkx *et al*. (2010) found similar results in one of their cases, in which fully developed business plans presented to potentially interested farmers gave the farmers a feeling of having no room for input and scared them of. VL, on the contrary, started from the close interaction between a brewery, an intermediary firm and farmers, resulting in the involvement of important stakeholders from its outset (Figure 6-4). This interaction was maintained throughout VL's development (e.g., in the foundation board in which discussion and negotiation was fostered). The involvement and mutual interactions between farmers and market actors was perceived as beneficial, because it motivated farmers to participate as "*it creates trust and hopefully coincides with a better position of the farmers towards the buyers"* (VL Farmer, 2014). Specifically, the intermediary firm's connections played an important role in both the communication between farmers and chain partners and the attraction of new farmers and

chain partners at VL's earlier phases. Later, the ambition to set up sustainable product chains and to restore the social context between farmers and society, boosted the stakeholder involvement even more.

6.6.2 Meaning dimension

This dimension is related to the changed meaning of concepts (the subject of sustainable development) and goals (the intended target group and communication towards society) occurring during SFI development. In their research on the scale dynamics of grassroots innovations, Hermans *et al*. (2016) argued that new opinions in a growing initiative can take its development in a different or opposing direction from what has been the initial ambition of pioneering actors.

Both cases differently developed their subject of sustainable development. In BB, sustainable development was focussed at farm level from its outset (Figure 6-3), as it was inherent to the ISO14001-tool they used. No further developments or issues were perceived on this account. In VL, growing insights in sustainability resulted in the decision to broaden the subject of sustainable development from barley to the whole farm. This opened the perspectives to involve other food processors besides the brewery, which manifested in phase 3 (Table 6-2). In Phase 4, the subject expanded even more, when VL's objectives broadened towards the construction of sustainable product chains.

Further, our analysis shows a shift regarding the proposed motivation of the targeted farmers in both SFIs. In the beginning, they tended to focus on farmers that are intrinsically motivated to sustainably develop their farms, without other benefits or rewards being attributed to their participation. However, in their pursuit to attract more farmers, the SFIs tended to include rewards in participation, thus also appealing to externally motivated farmers. For example, BB unsuccessfully tried to pertain advantages for BB farmers in the CAP greening measures, VL successfully took some actions in phase 4 such as a financial surplus for sugar beets produced by VL farmers and advantages for VL farmers to meet the CAP regulations (6C in Figure 6-4).

Further, meanings shifted in how to communicate towards society when the variety in actors and stakeholders increased. In both cases, the initially involved farmers had a clear stance on measuring on-farm sustainable development (Figure 6-3 and Figure 6-4). As they believe on-farm sustainable development is a matter of mentality change and awareness creation, they did not value measuring and communicating progress on this account. However, when the link with the market and society was explicitly made in VL's fourth developmental phase, they felt urged by stakeholders to provide results about their activities and searched for ways to "measure" achieved progress. The urge to reflect on the

direction and to build shared meaning when a community grows is also reflected in other multi-actor collaborations (Koopmans *et al*., 2017).

6.6.3 Institutional dimension

In our cases, this institutional dimension is influenced by funding and formalization of the participation rules and the SFI organization. We define formalization the increased structure in role and task assignments, and roles and procedures that one has to be adhere to. We found that formalization is related to a growing number of participants. Provan and Kenis (2007) recognized that as the number of participants increases and the level of mutual trust and goal consensus declines, networks benefit from having a separate administrative entity to govern the network and its activities, such as VL's daily management group. Further, Matopoulos *et al*. (2007) recognized that the lack of suitable tools negatively influences information exchange and collaboration between collaborating supply chain actors when the number of companies increases.

The first relevant element in this dimension is funding, which highly influences the longevity of the SFI. Both our cases show that project funding is an easy way to start an initiative, but can also inhibit to find a self-supporting way to operate. In BB, they never managed to pass the state of temporary funding (Figure 6-3), whilst VL succeeded in developing a self-supporting organization to which all participants contribute.

Second, both cases show that farmers tend to dislike the administrative work load accompanied with formalization. BB's choice for ISO14001 certification as a tool for on-farm sustainable development, already implied a high formalization status from the very start without benefits on the market (Figure 6-3), which repelled farmers from participating. In VL, on the contrary, formalization grew gradually by adjusting the tools to deal with the growing number of participants. In their research on alternative agri-food networks, Higgins *et al*. (2008) also found that (EMS) certification was not deemed suitable to build alternative markets for farmers. However, as some farmers in BB, the farmers that did participate in Higgin's case valued the EMS process for personal benefits regarding on-farm environmental management, without being bound to the formalities of certification. Although BB did not specifically focus on obtaining a certificate and tried to stress the personal advantages by using participating farmers' testimonies during its recruitment activities, it did not succeed in attracting farmers to participate. Based on our data, it is not possible to determine whether the different response of farmers to the higher degree of formalization in both cases resulted merely from the degree and other characteristics of formalization or from the way the formalization found its entrance in the SFI (i.e., gradual and with farmer participation in VL or immediate and beyond control of farmers in BB), or both.

Third, comparing both cases, organizational formalization seemed highly related to the number of participants involved. This is what Koopmans *et al*. (2017) also found in their evaluation of multi-actor governance systems, i.e., when organizations feel the need to scale up, they develop more formal structures for their organization. In BB, the low degree of formalization was caused by two problems: the work load of the Flemish facilitator, who had to deal with administrative tasks related to their involvement in the Interreg-project, the support of on-farm sustainable development, and the work load associated with the "imported" ISO14001 tool that was not yet adjusted to the Flemish context. They did reach a higher degree of formalization in some extent by creating a foundation to lower the administrative work load for farmers during ISO14001-certification. However, the foundation did not solve the problems related to the work load of the facilitator. In VL, formalization first increased with the creation of Foundation Skylark. Later, in Phase 4, several governing bodies were created, such as a daily management group of paid employees to manage VL's activities in the growing community. Further, suitable tools were created to guarantee quality of the on-farm sustainable development process, the intra-organizational knowledge exchange and communication towards society.

6.7 Factors influencing expansive learning

So what can we conclude now on the expansive learning of the SFIs? We refer to expansive learning as the SFI's ability to define contradictions and collectively negotiate and implement solutions for these contradictions that lead to a wider horizon of opportunities. Referring back to the CHAT, we make three major reflections: regarding the role of history in the development of an SFI, the role of contradictions in the development of the SFI, and the relevance of this expansive learning for the learning on on-farm sustainable development.

First, our results confirm the importance of historical decisions and the context situation in the development of SFIs. For example, both cases started as a short term project but they evolved differently. Our results show that contextual situations or decisions taken in the past define the potential directions of the SFI development and thus the current state of the SFI. For example, the successful close interactions between different actor types (farmers, brewery, intermediary firm) at the outset of Veldleeuwerik, became embedded in Veldleeuwerik's governance culture through the development of the VL approach for on-farm sustainable development (e.g., knowledge exchange between farmers, advisors, and chain partners) and the different governance bodies (e.g., the foundation board). On the other hand, our research indicates that the embedding of BB in the Interreg-project seemed to have induced contradictions in the activity system (e.g., between ISO14001-tool and the

socio-cultural, legislative and market rules for farmers) and also limited its potential to tackle them (e.g., the discussing the ISO14001-tool was out of question). These findings confirm the statement of Roep and Wiskerke (2012) who investigated the development of alternative sustainable food networks, that specific settings at the outset can create a lock-in that hampers further development.

Second, our results indicate that contradictions can play different roles in the SFI development. CHAT posits that contradictions are a driving force for development and expansive learning of SFIs. Our analysis shows that similar contradictions took place during the development of VL and BB (Table 6-3 and Table 6-4). Examples are contradictions between the community and the division of labour that cause funding problems (BB7 in Table 6-3 and VL2 in Table 6-4), contradictions between the object and the division of labour in which the combined responsibility of organizational and practical tasks inhibited the support of actual on-farm sustainable development (BB6 in Table 6-3 and VL5 in Table 6-4), contradictions between the community and tools showing that tools require adjustment when the size of the community changes (BB1 in Table 6-3 and VL10 in Table 6-4). Our research shows considerable differences in our cases' success to tackle these contradictions. Moreover, BB's accumulation of impasses in multiple directions to solve the contradictions eventually inhibited its good performance as an activity system and negatively influenced its development. Our research thus indicates that when too many impasses to overcome contradictions take place, they can lower the activity in the activity system and result in passivity to involve actors.

According to CHAT, potential solutions for contradictions are inherent to the activity system and can be collectively produced by the activity system. However, our first reflection indicates that certain conditions can stimulate or inhibit the SFI's ability to tap into this potential of solutions inherent to the activity system. For example, our analysis of the developmental history of BB indicates that when certain elements of the activity system are fixed and not open for change or adjustment (e.g., the ISO14001-tool), it might reduce the expansive learning potential of the SFI. On the other hand, the analysis of the developmental history of VL indicates that the involvement of multiple actor types who represent of the relevant stakeholders from the agri-food system in the SFI's activity system of the SFI, increases the SFI's set of potential solutions to deal with contradictions. However, other authors state that differing views within a community can cause tensions within collaboration networks, which can be either enriching and facilitate creativity, or impede new ideas and actions (Ring, Peredo and Chrisman, 2010; Tisenkopfs *et al.*, 2015).

Third, our research indicates the relevance of expansive learning at the level of the SFI for the support of farmer learning on on-farm sustainable development. VL's expansive

learning cycles that resulted in consecutive redefinition of the SFI's object, and increasingly widened the SFI's horizon of opportunities, shows that the meaning of what sustainable development entails changed throughout its history (from focus on a crop, towards focus on the whole farm, product chains and the link with society). Consequently, also the approach on how this sustainable development can be achieved (required tools and community) changed. So, this interpretation and meaning making at the level of the SFI inevitably penetrates into the learning and meaning making of the individual farmers involved in the SFI. This means that the learning on on-farm sustainable development, the awareness creation and meaning making already starts from the very outset of the SFI, when the objective of the SFI is negotiated. To make sure that this meaning making of sustainable development is relevant to all important stakeholders, this learning process at the level of the SFI benefits from the equal position and involvement of these stakeholders in the governance processes of the SFI. More specifically, it suggests that farmers can benefit from the involvement in these governance processes when they want to learn on on-farm sustainable development. In VL, this is reflected in the equal position of all actor types, the bottom-up approach, and mutual trust and communication. The equal position between all major actor types involved (chain partners, farmers, intermediary firm, farm advisors) is maintained in different ways, e.g., all actors contribute financially to VL according to the firm size and all actor types are represented in the foundation board. Roep and Wiskerke (2012) found that maintaining an equal position for specific actor types can be difficult when strong chain partners enter an initiative, as they may want to have some control on the marketing aspect of an initiative. So, the increased participation of powerful chain actors in VL was a possible threat for the equal positions. However, the farmers' representation in multiple boards within VL guarded their voice in decision making. Also Klerkx *et al*. (2010) found that an initiative should constantly build shared discourse and meaning together when the community's actors evolve.

6.8 Conclusion

In this Chapter, we used CHAT to understand the differences in two SFIs' ability to successfully develop into an established SFI, that is durable and recognized for being an SFI. We argued to understand this difference in success, we needed to investigate the SFIs' developmental history. To do so, we used four CHAT concepts to scrutinize how our SFI cases function(ed) as activity systems, and how contradictions within and between the elements of the activity system emerged and were dealt with by the cases' community. Our interpretation of the, often similar, directions in which the SFIs attempted to overcome the contradictions, enabled us to define elements and dimensions of the zone of proximal

development, i.e., the possible future directions of development of an SFI. Based on these elements and dimensions we were able to reconstruct our cases' developmental path in the ZPD, and detect directions that resulted in expansion and impasses.

Based on these results, we made three major reflections on expansive learning of SFIs. First, our research indicates the importance of historical decisions and the context situation on the development of SFIs. The contextual situations or decisions taken in the past define the potential directions for (future) SFI development and thus the current state of the SFI. Second, our results indicate that contradictions in the SFI can either act as a driving force for development and result in expansive learning, or they can result in lowered activity and development when the SFI fails to overcome them and impasses accumulate. Our research further suggests that when certain elements of the activity system are fixed and not open for change or adjustment, it might reduce the expansive learning potential of the SFI. In contrast, the involvement of multiple actor types in the SFI's activity system, who represent the relevant stakeholders from the agri-food system, increases the SFI's set of potential solutions to deal with contradictions. Third, our research indicates the relevance of expansive learning at the level of the SFI for the support of farmer learning on on-farm sustainable development. This is because the interpretation and meaning making on sustainable development at the level of the SFI inevitably intrudes into the learning and meaning making of the individual farmers involved in the SFI. To make sure that this meaning making of sustainable development is relevant to all important stakeholders, this learning process at the level of the SFI benefits from the equal position and involvement of these stakeholders in the governance processes of the SFI. This also includes the farmers.

CHAT provided a good framework to understand the complexity involved with the development of SFIs. By uncovering the underlying causes for perceived problems in the development, we were able to understand BB's and VL's differences in success to develop into an established SFI. Further, our research also adds some nuances to the role of contradictions in the CHAT-framework and contributes to our understanding of the relevance of the SFIs' expansive learning for the support of on-farm sustainable development and their development towards an established SFI.

CHAPTER 7.
General discussion

In previous empirical Chapters 4 to 6, we answered our research questions 2.1 to 2.3 on the relevant dynamics between participating farmers and the SFI. In this Chapter 7, we will reflect on this research in two main sections. In the first section, we articulate our main findings from Chapters 4 to 6, to answer our overall research question *RQ3. What are key dynamics and characteristics for SFI design that successfully facilitate farmers' learning for on-farm sustainable development?*. To do so, we use the practice-based approach presented in Chapter 2 (section 2.3.3). In the second main section of this general discussion, we critically discuss the contributions and limitations of our research and make suggestions for further research on farmer participation and learning.

7.1 Articulating key dynamics and characteristics in SFIs using a practice-based approach (PBA)

In this section, we aim to articulate the insights from our empirical Chapters 4 to 6, to answer our research question 3, i.e., *What are key dynamics and characteristics for SFI design that successfully facilitate farmers' learning for on-farm sustainable development?* To do so, we use the practice-based perspective (PBA) introduced in section 2.3.3, based on which we describe an SFI as a practice, i.e. the practice of SFI or SFI practice. We use a PBA that describes a practice as the interplay between four components, i.e., a set of routinized activities, human agency, material-functional structure and socio-cultural structure. Translating our research question into these PBA-terminology, we are thus mainly interested in the farmers' agency to participate in the learning activities of the SFI, and how the other PBA components can contribute to this agency.

7.1.1 Link between the perspectives of the empirical chapters and PBA

Each theoretical perspective used in Chapters 4 to 6 contributes differently to the understanding of the four PBA-components. We started with a rather individual-centric

approach in Chapter 4, a more integrated perspective taking the social interactions in the SFI as entry point to understand participation in Chapter 5, and an integrated systemic perspective on participation in SFIs in Chapter 6. Each research approach applied thus a more integrated perspective than the one used in the preceding Chapter. In following paragraphs, we elucidate how we link these perspectives to the PBA –components and how thus each perspective used, gradually provides a richer picture of the components of the PBA.

In Chapter 4, we investigated farmers' motivation to participate in an SFI, using Self-determination Theory (SDT). This Chapter primarily informs us on the PBA-component of farmers' agency to participate in the practice of SFIs. Human agency involves the primary or basic stance needed for the repeated performance of the practice (Crivits and Paredis, 2013). In the context of this research, for the practice of SFIs to be performed, it requires that farmers are motivated to engage in SFI activities, by sharing knowledge and being willing to learn on sustainable development on their farm. Using the SDT in Chapter 4, we were able to explore how qualitative motivation towards engagement in SFI activities can be obtained and fed. SDT shows that the motivation of farmers to participate is not a purely individual matter, but can be influenced by the farmers' social environment and thus characteristics of the socio-cultural and material-functional structure components of the PBA.

Further, we argue that the outcomes of participation in the initiative itself, and the value created within the SFIs for farmers also feed back to the farmers' agency to participate. For example, if their participation is perceived as valuable, farmers will more likely keep on contributing or even increasingly engage in the SFI's activities. More insights on this account are offered through our research in Chapter 5. In this Chapter 5, we used a Communities of Practice (CoP) perspective and the Value Creation Framework (VCF) to inform us on how the social interactions in which the farmers participate in an SFI create value for them. This research thus provides insights in the specific set of routinized activities and characteristics of the structural components that contribute to value creation and thus farmers' agency to participate in activities of an SFI.

As stipulated in Chapter 2, we recognize two levels of governance processes in SFIs. The first involves the activities related to the support of farmer learning, the second involves the activities related to the development of the SFI. Our use of the SDT and the CoP/VCF perspective in Chapter 4 and 5, so far mainly inform us about the first type of governance processes related to the support of farmer learning, i.e. how farmers should be motivated to participate in farmer learning activities and how the farmer learning support can be organized to create value for farmers that contributes to their agency. However, we

argue that the second type of governance processes, related to the development of the SFI can also contribute to insights on the farmers' agency. The development of the SFI involves how objectives are set, decisions are made, meanings are negotiated and the SFI discourse on sustainability, learning and participation is developed. According to the PBA, the SFI development can be interpreted as the emergence of the routinized activities, the material-functional and socio-cultural structure at a given moment in time.

To increase our understanding on how these components of an SFI emerge, we used Cultural-Historical Activity Theory (CHAT) in Chapter 6 to reconstruct the developmental history of two SFIs. CHAT offers an integrated and systemic framework of interconnected elements that allows to describe an SFI as an activity system. This framework allowed us to reconstruct and define how the interplay between the actors, instruments, rules, task divisions and the object in the SFI changed and thus contributed to development and learning of the SFI as a whole. Using this perspective, another type of agency of the farmers (and other actors involved) in the SFI is highlighted, i.e., their ability to contribute to the development of the routinized activities, socio-material and socio-cultural structure that constitute the farmer learning activities in the SFI. The CHAT perspective used in Chapter 6, thus informs us about the socio-cultural structure, the material-functional structure and the routinized activities that favour the sustained agency for participation of farmers in the SFI.

7.1.2 Agency of farmers to participate and engage in SFIs

In this research, we focus on the farmers' agency, i.e., the farmers being practitioners of the SFI practice through their engagement and participation in the routinized activities of the SFI. Self-Determination Theory (SDT) introduces the concept of quality of motivation, and links specific types of motivational orientation to more qualitative performance of tasks, activities and learning. The motivational orientation thus allows to make predictions on the farmers' agency in the SFI activities and the quality of the performance of the practice. For example, Gagné (2009) who proposed a model for knowledge-sharing motivation argues that the type of motivation to share knowledge can lead to differences in the quality of the knowledge sharing behaviour and also of the knowledge that is shared. She gives the example of an intrinsically motivated person who will spontaneously and passionately share knowledge with others, whether or not it is requested. In contrast, a person who shares knowledge because it gives him the opportunity to boost his image or impress colleagues (introjected motivation) may share knowledge that is less useful to others. So, the farmers' agency in the activities of the SFI will depend on their motivational orientation. According to SDT, to realize a good performance of the SFI practice, farmers are preferably

autonomously motivated to participate in an SFI. Such a motivational orientation reflects personal endorsement and a feeling of choice in the performance of the behaviour and is related to an increased actual involvement, engagement and performance (Vansteenkiste *et al*., 2010).

However, as shown in Chapter 4, farmers often are controlled motivated to participate in the farmer learning activities set up by an SFI. For example, they are often persuaded to join an SFI because of promised rewards, such as higher product prices or a sustainability label, or because they feel pressured by their product buyers to participate. In fact, such controlled features proved very useful to nudge farmers to join an SFI (Mills *et al*., 2016). However, following SDT, this could negatively influence the farmers' agency in the routinized activities of the SFI. So, how can SFIs then obtain the "right" farmers' agency?

Interestingly, SDT shows that internalization of motivation can occur when the psychological basic needs of autonomy, competence and relatedness are met. Inspired by SDT, Chapter 4 shows that this internalization process towards autonomous motivational orientation can be influenced by the environment in which the farmers act. SDT can thus offer guidance on required characteristics of the material-functional and socio-cultural structure that contribute to the creation of the farmers' autonomous motivational orientation. This can be done by providing a participation context for the farmers that supports the three psychological basic needs of autonomy, competence and relatedness. An autonomy supportive environment increases the farmers' feeling of control and volition of their own behaviour (Ryan and Deci, 2000a; Vansteenkiste, Niemiec and Soenens, 2010). This can be created by provision of decision making power, opportunities for initiative, and by avoiding evaluation, deadlines, and surveillance (Gagné, 2009). A competence supportive environment is well-structured, to increase the feeling of competence and efficacy in the SFI activities (Ryan and Deci, 2000a; Vansteenkiste, Niemiec and Soenens, 2010). It can be created by the provision of information and resources, education, optimal challenges and goals, and constructive feedback (Gagné, 2009). A relatedness supportive environment is warm and supportive, and increases the feeling of relatedness to important others within the SFI (Ryan and Deci, 2000a; Vansteenkiste, Niemiec and Soenens, 2010). It can be created through increased interactions, supporting cooperation, sharing experiences and acknowledging feelings (Gagne, 2009). Our findings in Chapter 4 indicate that the SFI Veldleeuwerik provides such a context, specifically through the organisation of knowledge exchange in farmer groups, supporting personal goal achievement, and by giving the farmers the feeling of being a crucial actor who is valued by its peers, the SFI organization and the chain actors.

Besides the basic needs supportive environment in which the farmers participate, we argue that also the outcomes of participating in the SFI can feedback into the farmers' agency. To understand this dynamic, we thus need to gain insight on the outcomes that participation in the SFI activities create for farmers and how they value them. This will be addressed in the following section.

7.1.3 Routinized activities and material-functional structure to sustain agency

In the previous section, we suggested that the routinized activities in which the farmers act, and the outcomes of the performance of these routinized activities can feedback into the farmers' agency. Based on this proposition, we reason that farmers who highly value the outcomes of their participation in the activities, will generate a positive stance towards the performance of the routinized activities of the SFI. Therefore, we are interested in the type of routinized activities and the characteristics of the structural components of the SFI practice that contribute to both the farmer agency to participate and engage in the learning activities of the SFI.

In Chapter 5, we used a Communities of Practice perspective (CoP; Wenger *et al*., 2002) and the Value Creation Framework (VCF; Wenger *et al*., 2011) to investigate how farmers valued their participation during activities in an SFI. The VCF distinguished five types of value (immediate, potential, applied, realized, reframing), which we were able to attribute to specific types of activities and structural characteristics of the SFI practice. This research indicates two complementary types of activities that should be part of the set of routinized activities of the SFI practice according to the farmers that participated in the SFI of DAIRYMAN. Further, the value creation analysis also provides insights on how characteristics of the structural components can contribute to the performance of these activities that favour farmers' agency to engage in them.

Set of routinized activities

Based on the analysis in Chapter 4, we suggest two complementary types of routinized activities that favour farmers' agency to engage and participate in them: group activities and individual farmer activities.

The group activities involve activities in which groups of farmers are brought together (sometimes with other actors) and in which more general knowledge on sustainable development (i.e. that is not tailored to one specific farm) and what it entails is negotiated and discussed. The group activities contribute to the performance of the SFI practice in two ways: they create awareness on the sustainability concept and they contribute to community

building and trust. First, Chapter 5 shows that being confronted with other perspectives on sustainable development and farming was perceived as very enriching by the farmers. It resulted in awareness creation on the sustainability concept and what it might entail for their farm management. During such farmer group activities, the concept of sustainable development is thus negotiated and given meaning for the farmers. It thus gives farmers some grip on the sustainability concept and makes it tangible for them. This characteristic of group activities can contribute to their basic need for competence and autonomy satisfaction. The increased knowledge on what sustainable development might entail on their farm, can contribute to autonomous decision making on their farm, e.g. through awareness creation on what the impact of their farm management is and how it can be changed. As this knowledge building on the sustainability concept might not always be explicitly addressed in these group activities, we suggest to include reflection moments on this account. This should stimulate the change of frames of reference, norms and attitudes. Second, Chapter 5 also shows that these farmer group activities contribute to community building and trust. This is important, as it enhances the farmers' feeling of relatedness to the other participating farmers and actors in the groups.

Individual farmer activities address the farmers' interest in farm- specific knowledge that is directly relevant and/or applicable on their farm. It involves knowledge exchange between different (types of) actors, but with the specific focus on generating knowledge for a specific farm. For example, in DAIRYMAN-Northern Ireland (Chapter 5), this activity type was structured as close encounters of knowledge exchange between farmers, researchers and advisors. The increased insights in the farmer's farming system following from this specific knowledge creation process can contribute to both the farmers' feeling of competence and autonomy to make changes on his farm. Further, such close interactions between a farmer and other actor types can increase their feeling of relatedness.

Characteristics of the material-functional structure

Our research in Chapter 5 shows that the performance of both these types of routinized activities can be supported by specific characteristics of the structural components of the SFI practice.

First, Chapter 5 indicates the importance of specific roles in the above described routinized activities. In the farmer group activities, the role of facilitators includes bringing together and facilitating the discussion and negotiation between different perspectives on sustainable farming. Chapter 5 indicates that facilitators preferably have a broad knowledge on the domain of the SFI practice to facilitate the knowledge creation process. Further, an important role is given to advisors, being a translator of knowledge into farm-specific advice.

However, it should be stressed that not all advisors fit this role, and should hold specific competencies to effectively contribute to the routinized activities of the SFI practice (Ingram, 2008).

Second, Chapter 5 also provides information on the preferred type of location for these activities. The DAIRYMAN farmers attributed great value to locations that provide first-hand and real-life experiences to the farmers. Such first-hand experiences contribute to the exchange of tacit knowledge, which is difficult to express and held in the practices of its performers. For example, being confronted with another farmer's perspective on sustainable farming at this farmer's farm adds to a richer pallette of knowledge sharing. This increases the mutual understanding of the management decisions farmers make and adds to the farmers' feeling of relatedness. This reasoning equally holds for knowledge sharing with other actors. In this way sites for the above described activities can be, for example, farms, production sites of chain actors, experimental farms, or field trials.

The above descriptions provide information on how the routinized activities and characteristics of the material-functional structure of the SFI practice can contribute to farmers' basic need satisfaction and agency to participate. However, according to Gagné (2009), this satisfaction of basic needs does not necessarily contribute to an open stance towards sharing data and sharing experiences. According to Gagné (2009), it also requires the presence of "sharing norms" within the group. For example, an open knowledge sharing culture that is permeated throughout the SFI's governance levels, likely positively influences the farmers' knowledge sharing behaviour. Equally other aspects of the social-cultural structure can contribute to the agency of farmers to engage and actively participate in the routinized learning activities of SFIs. But can such a socio-cultural structure, as the material-functional structure and the routinized activities be conducive to the agency of farmers? This is discussed in following section.

7.1.4 Influence of the developmental history and the socio-cultural structure on agency

Our research in Chapter 6 indicates the importance of the developmental history of the SFI on its performance and the agency of farmers to participate. Interestingly, all our cases started as a short term project, but evolved differently. By using the Cultural-Historical Activity Theory (CHAT) in Chapter 6, we reconstructed the historical development of two SFI's to understand the dynamics underlying their learning and developmental processes as SFI throughout the years. Reconstructing the developmental history allows us to understand how the PBA components of the SFI practice emerged, were consolidated and changed during the course of the SFI's existence. It shows how decisions made at the

outset of an SFI, are incorporated into the SFI's routinized activities, material-functional and socio-cultural structure. For example, the equal positions and involvement of multiple actor types in the Veldleeuwerik case at the outset, was eventually put forward as a baseline for the further development of the initiative (e.g., all actors types contribute financially to the SFI, are represented in the governing bodies of the SFI, and are involved in the decision making processes).

In Chapter 6, we investigated how the multiple actors in the SFI community (each with their own agenda and dispositions), succeeded or not in overcoming internal contradictions and frictions within the SFI. This shared learning history allows to distinguish those actors who were involved in the SFI practice from those who are not (Wenger, 2010). Compared to the other perspectives it also contributes to insights on how the socio-cultural structure can influence farmer participation in the learning activities of the SFI. Chapter 6 shows that both visions, discourses and dispositions of actors internal and external to the SFI contribute the socio-cultural structure of the SFI practice. We observed two main issues regarding the agency of farmers to participate in SFI activities. First, learning on sustainable development does not only take place in specifically organized activities for farmers, but also during the development of the SFI practice. Second, stakeholder involvement in SFI development can influence farmers' agency in an SFI.

First, reconstructing the developmental history indicates that the learning on sustainable farming starts from the outset of the initiative, by practicing the current state of the SFI, but also through negotiating and discussing the SFI's object and perspective on sustainable farming and learning. In this way, these processes of negotiation on the SFI development, can be interpreted as a kind of routinized group activities (see previous section 7.1.3) in which general knowledge on sustainable development and what it entails is negotiated and discussed. This thus advocates for the active involvement of farmers from the early development of the SFI, as it contributes to the farmers' feeling of competence, relatedness and autonomy. Further, the involvement of the different actor types also contributes to the creation of the practice, which positively influences the agency to participate in the routinized activities of the SFI by all those actor types.

Second, Chapter 6 indicates that also dispositions, practices and expectations from external actors can influence the agency of the farmers. For example, the Beloftevol Boeren case shows that indifferent or even critical dispositions of chain actors towards the SFI negatively influenced the agency of the farmers to participate in the routinized activities. Likewise, as indicated by the cases of MOTIFS and Beloftevol Boeren, we argue that also conflicting or concurring dispositions and expectations between society, policy, and funding bodies and the SFI's vision and disposition can negatively or positively influence the

farmers' agency to participate. Chapter 6 thus indicates that prevailing norms, practices and dispositions of the agri-food system in which the SFI is inevitably embedded, intrude into the practice of the SFI and can cause conflicts with the prevailing norms and routines in the SFI (e.g., specifications asked by chain actors can conflict with requirements from the SFI for farmers). Moreover, the Beloftevol Boeren case indicates that the inability to overcome contradictions within the SFI can be linked its inability to include actors of the agri-food system in the SFI development. As many other authors have argued, negative impacts of insufficient actor involvement advocate for broad stakeholder involvement in the development of the SFI to align the socio-cultural structure with prevailing norms, practices and discourses in the agri-food system. However, this interpretation of the stakeholder involvement in the PBA perspective gives another dimension to stakeholder involvement in the development of the SFI. Not only does the stakeholder involvement contribute to the alignment and embedding of the SFI in the agri-food system, but through the inclusion of the dispositions and expectations of the stakeholders in the SFI, they seem to also contribute to the farmers' agency to participate in the learning activities of the SFI.

7.1.5 Key dynamics in SFI practices

In previous sections, we have articulated the results from our empirical research through the use of a PBA perspective. By taking farmers' agency to participate in the routinized activities of the SFI as an entry point, the PBA perspective was an aid to define the interactions between the PBA components that favour this farmers' agency, i.e., the farmers' motivational orientation, the provision of a basic needs fulfilling context, the organisation of group and individual farmer learning activities, the historical development of the SFI practice and the dispositions, practices and expectations of external actors. In Figure 7-1, we give an overview of these key characteristics, that according to the perspectives we used in our research contribute to the farmers' agency to participate in the SFI activities. Further, in Chapter 8, we translate these findings into practical guidelines for actors involved with SFI design and development (using examples from our cases) on how to stimulate farmers' agency to participate in an SFI.

Figure 7-1. Overview of key characteristics of SFI practices that favour farmers' agency to participate in SFIs, using a practice based perspective.

7.2 Reflection on the research approach and suggestions for future research

7.2.1 Reflection on the perspectives used

In this research, we used four perspectives to unravel key dynamics at play related to farmers' participation and learning in SFIs and to create a rich understanding of these complex dynamics. Overall, we perceived the use of these different theoretical perspectives as inspirational to broaden our perspective on how to define SFIs and how to understand the dynamics that take place in SFIs. Our results in the empirical chapters and section 7.1 show that each perspective has its specific value for this research. Despite their value, we also experienced some shortcomings related to these perspectives and the way we applied

them in this research. In following sections we will discuss the contributions and shortcomings of each perspective for answering our research questions.

7.2.1.1 Self-determination theory

To answer research question RQ 2.1. *What is the motivation of participating farmers to participate in voluntary SFIs, and how is this motivation influenced by the participation context created by the SFI?*, we used Self-determination theory (SDT). Using this perspective we took the individual farmer and his motivational orientation to participate as an entry point to understand farmer participation in SFIs. Unlike other research that tried to understand farmer participation in SFIs (e.g. Wilson, 1997; Burton, 2004), this theory does not focus on specific factors (e.g., age, education, farm size) that influence farmer participation, but allows to understand underlying psychological processes that influence farmers' motivation towards engaged participation in SFIs. Although SDT has been applied in the field of agriculture to a limited extent, its use contributed to our understanding of farmer participation in multiple ways. It provided insights in the motives and motivational orientation of farmers to participate in an SFI, the types of motivation that favour high quality engagement, a better performance and deeper learning, and SFI characteristics that positively contribute to these types of motivation.

Another theory that is frequently used in research on farmer behaviour is the Theory of Planned Behaviour (TPB) (e.g., Lokhorst *et al.,* 2011*;* Mills *et al.,* 2016*)* and proved successful in predicting behaviour. This theory assumes that the farmers' intentions capture the motivational factors that influence behaviour (Gagné, 2009), and charts the process of how intentions are created and converted into behaviour (Hagger and Chatzisarantis, 2009). According to TPB, three factors influence these intentions: the attitude towards the behaviour (i.e., "*the degree to which one evaluates the behavior favorably or unfavourably* (Gagné, 2009, p.572)., the subjective norms regarding the behaviour, and the perceived behavioural control over the behaviour (Gagné, 2009). According to TPB, stronger intentions of farmers to participate in an SFI would increase the likelihood that they will actually participate. However, insights from SDT show that this is not always the case, because it links the type of motivation to engage in an SFI to the quality of the participation and thus the degree of engagement. Some researchers therefore suggest the complementary use of SDT and TPB, and constructed a model that allows to measure concepts that are related to both theories; e.g., Gagné (2009) and Hagger and Chatzisarantis (2009). Other authors added the concepts of self-identity, social/group norms, response efficacy, personal norms and/or personal moral obligations (e.g., Lokhorst *et al.,* 2011; Van Dijk *et al.,* 2015; Mills *et al.,* 2016) to the factors of TPB to obtain a more comprehensive picture of farmers' willingness to engage in a behaviour. We believe that

these concepts would also provide interesting insight in the farmers' positive of negative stance towards participation in SFIs.

Our research only investigated the influence of a few SFI characteristics on the basic needs satisfaction of farmers participating in the SFI. However, other characteristics might equally influence basic needs satisfaction. To give a more extensive overview of SFI characteristics that influence basic needs satisfaction, and to enable generalization of these results, more research is needed. Further, in our research we did not take into account the feedback of the outcomes of the farmers' participation in the SFI on the farmers' motivation to participate, e.g., their growing knowledge on sustainable farming, the successful implementation of specific sustainability measures on the farm, increased appreciation by neighbours and chain actors. However, SDT offers some inspiration of how such outcomes might contribute to basic needs satisfaction. For example, the farmers' feeling of competence can increase by experiencing progress in their on-farm sustainability, and by achieving the identity of being a "good farmer" by neighbouring farmers. Likewise, their feeling of relatedness can be fed by increased respect from neighbours and chain actors. Or, their feeling of autonomy can be fed by feeling able to set own sustainability goals as they increase insight in their farming system and the impact of their farm management. Further research on the outcomes of participation and how they feedback into the motivation to participate requires further investigation.

7.2.1.2 CoP and VCF

We used the perspective of Communities of Practice (CoP) and the Value Creation Framework (VCF) to answer our research question 2.2, *How do different design characteristics contribute to perceived value creation for farmers participating in an SFI?* This allowed us to gain insights on how and why farmers valued their participation in an SFI. Using the CoP-perspective, we took the social interactions that contribute to the farmers' learning as an entry point for investigating participation. Further, using the VCF, we were able to link distinct types of value perceived by farmers to specific types of social interactions related to their participation in an SFI. This allowed us to define the types of activities in SFIs that result into valuable outcomes for farmers.

It might be argued that the use of the CoP concept to describe the social interactions in an SFI is not consistent with its theoretical origins (Wenger, 2010). Indeed, the concept originated from the phenomenon of group based, situated learning in a workplace, and is described as a self-organized group of individuals bound by a specific practice, who learn to improve this practice through regular interaction (Brown and Duguid,1991; as referred to in Ingram *et al.*, 2014). In this way, defining SFIs that bring together actors in a (temporary)

project as CoPs, seems to conflict with the broader framework in which the CoP concept originated. In general, the application of the CoP concept has come to be used more loosely to describe a number of organizational and spatial learning settings (Ingram *et al.,* 2014). To make a distinction with the original use of the CoP concept, the concept of networks of practice (NoPs) is often introduced. NoPs are characterized by looser ties and greater external influence (Wenger, 2010). However, Wenger (2010) prefers not to think in terms of community and network as being distinct structures. Rather, he advocates for the use of community and network as two types of coexisting structuring processes, the first emphasizing the identity and the second emphasizing the connectivity. Related to this, it has been criticized that CoP shifts from an analytical concept, which gives a name to the existing phenomenon of group-based learning through participation in practice, to an instrumental concept, which is used to deliberately create or cultivate such a process. Critics then argue that this evolution results in the potential loss of analytical sharpness (Wenger, 2010). Wenger (2010) suggests to use the tension between both uses of the concept as the beginning of a new discipline with a focus on understanding and enhancing the learning capability of social systems. From this perspective, he argues, a CoP is an interesting starting point and can be viewed as a learning partnership, of which "*its learning capability is anchored in a mutual recognition as potential learning partners"* (Wenger, 2010). He then defines a learning partner as a person with whom learning potential is created by focussing on practice. We believe that it is in this perspective on CoPs, i.e., to use them as a starting point to understand and enhance the learning capability in learning partnerships, that our use of the CoP- framework on the DAIRYMAN case should be framed.

Further, the VCF proved particularly useful for understanding the learning capability of the SFIs. It allowed to link specific activities of the SFI to specific outcomes. By focussing our research on the farmers' perceptions, we were able to define the types of activities that resulted in outcomes that were mostly valued by farmers. The hands-on guideline provided by Wenger *et al.* (2010) on how to use the VCF proved very useful to collect and interpret our data. Although we used the VCF for an ex-post analysis of our case, based on our findings, we believe this framework could be of high value for evaluation and reflection on operational SFIs to guide their future development and improvement.

7.2.1.3 CHAT

We used the Cultural-Historical activity theory (CHAT) to answer our research question 2.3, *Which organizational dynamics contribute to the development of an established SFI?.* We thus used CHAT to understand how SFIs develop into an established SFI, i.e. the learning that takes place at the level of the SFI during its development. CHAT proved a very comprehensive theory to understand change and development at the level of the SFI, by

defining them as object oriented and mediated activity systems. The analytical framework comprising the six elements of an activity system were a helpful tool to structure the complex information on what constitutes the activity of an SFI. Although it has been applied in agricultural research to a limited extent, reconstructing the interaction between the elements of an activity system did not only help us to understand how an SFI functions as a practice to support farmer learning at a given moment in time, but also to understand the SFI's history and how dispositions, discourses and norms (i.e. the socio-cultural structure) supporting the farmer learning activities emerge. This CHAT perspective contributed to our knowledge on SFIs by showing the importance of historical decisions, i.e. that decisions made in the past define and constitute an SFI in its present state, and that internal contradictions support the development and learning of an SFI. On the other hand, our research contributed to CHAT by indicating that when an SFI does not succeed in overcoming internal contradictions, it can result in impasses to develop in a certain direction and inhibit the further development of the SFI.

In this research, we mainly used CHAT to understand the dynamics of change within the SFI, and only to a limited extent included the dynamics between the SFI and the broader (societal, institutional, agri-food) context. However, Rivera and Cox (2016) argue that *"an adequate social theory needs to pay attention to three levels of analysis: micro (individual), meso (organisational) and macro (institutional)".* We concur with these authors because, as mentioned in 7.1.4, our research indicates that this context influences the development of the SFI and farmer participation. Therefore, we believe that further research at the macro level would contribute to the further understanding of farmer participation and SFI development. CHAT could be used with this purpose as it recognizes the existence of networks of interrelated activity systems that mutually influence each other, and between which contradictions can emerge. Similar to the ecology of practices referred to in section 2.3.3, the activity system of an SFI can be related to the activity system of food production, extension and education, research or policy and regulation.

In contrast, we argue that there might be an influence in the other direction too, i.e., from the SFI towards the broader context in which it is embedded. In this way, SFIs can be interpreted as an active agent within the Agricultural Knowledge and Innovation System (AKIS). Indeed, they bring together different actors of the AKIS to generate knowledge and achieve sustainable development (SCAR, 2012). This connection with different actor types in the AKIS is prominent in the case of Veldleeuwerik, in which connections exist with the market, research, the advisory system, banks, etc. For example, Veldleeuwerik actively promotes the connection between farmers and chain actors (both input suppliers, and processing industry, retailers and consumers) by organizing knowledge workshops in which

knowledge is shared between farmers and chain actors. Further, Veldleeuwerik farmer groups are involved in several specific research projects, e.g., regarding soils or pest control. It is thus interesting to investigate whether gained insights from within the SFI to stakeholders contribute to changes in the knowledge, dispositions and expectations on sustainable farming of actors in the broader context of the SFI who are not actively involved in the SFI activities. Indeed, this can in turn influence (or even favour) the development of the SFI. For example, policy makers can adjust regulations based on knowledge disseminated by the SFIs, and thus create opportunities to apply specific sustainable farming practices that could formerly not be applied. Also farm advisors involved in the SFI can play an important role in the dissemination of knowledge, through encounters with other (non-participating) farmers and with other advisors. CHAT could provide a useful framework to analyse these dynamics, however, this should be tested. Other frameworks that proved to be useful to investigate these dynamics between the SFI and its societal and institutional context can also be used. For example, Ingram *et al.* (2015) used a framework provided by transition literature, in which the interaction between SFI and its broader context could be defined as a the interaction between niche and regime.

7.2.1.4 PBA

To further articulate our findings from the empirical Chapters 4 to 6, we used a practice-based approach (PBA). We specifically used the PBA with the aim to increase our understandings on the agency of farmers to engage in SFIs and how this agency can be stimulated within the SFIs practice. It allowed to translate our findings that resulted from the use of the other perspectives, into specific SFI characteristics that contribute to the farmers' agency to participate and engage in farmer learning activities in the SFIs. It revealed more clearly that the motivational orientation, the provision of a basic needs fulfilling context, the organisation of group and individual farmer learning activities and the involvement in the development of the SFI contributes to the farmers agency to participate. The PBA thus proved a useful perspective to articulate our findings in terms of farmer participation in an SFI.

The versatility of the practice perspective provided us with sufficient anchor points to articulate the findings from our empirical research, and likewise provided enough degrees of freedom to adapt it to our focus on farmer participation in SFIs. The routinized activities-agency-structure framework forced us to use a systems perspective, which highly contributed to the in-depth understanding of the complex dynamics related to participation and learning in SFIs. However, as mentioned in Chapter 2, practice theory entails much more than the approach we used in this dissertation and we believe that our research only showed a glimpse of the possibilities of practice-based approaches for research on learning

in SFIs. We related two main limitations to the way we used practice theory in our research: limitations related to our choice to define practice at the level of the SFI and limitations related to our focus on farmer participation.

First, we perceived some difficulties related to defining the practice at the level of the SFI. We chose for a rather inclusive account of practices, in which a practice encompasses a collection of disparate activities (see section 2.3.1). This prevented us to go into detail on more specific practices such as farmer discussion groups, or the practice of sustainable tillage. Our meta-view on SFIs sometimes made it hard to translate the concepts from practice theory to this research. This specific inclusive focus on the practice of SFIs allowed us to define SFI characteristics that contribute to farmers' agency to participate and engage in the SFI, but fails to answer "how" exactly farmers learn during their participation. Hager and Johnsson's (2012) for example emphasize the process of how meaning and meaningfulness are generated, taking into account *"[t]he significance of cross-dialogue, interactions, symbolic inferences, attributed motivations, body language and other forms of sense making that construct the ways people learn together"*. These aspects are not often taken into account in learning research (Hager and Johnsson, 2012). We content that practice-based research at more detailed levels within the SFI's would provide an interesting contribution to further articulate the insights on required SFI characteristics to stimulate farmer learning, e.g. at the level of discussion groups, farm demonstrations or organization board meetings. Such an approach would allow to analyse how exactly (social) learning takes place within the activities we defined in section CHAPTER 7 (e.g., as performed by Beers *et al*. (2016) who linked patterns of interaction during meetings to social learning outcomes produced by an innovation initiative of greenhouse growers in The Netherlands). We believe that practice theory (but not necessarily the approach we have used) can further contribute to our understanding of these learning processes. Such a detailed understanding on social learning processes, would possibly also contribute to insights on the required stances and competencies of different actors' roles needed in these learning processes, a topic that only received very limited attention in this research.

Second, we used the PBA to focus on the farmers' agency to participate in an SFI. However, as shown in our research, also agency from other actors is required for the successful performance of the SFI practice. In this research, we did not go into detail on this. An issue related to the other actors' agency, is that these actors are often representatives of an organisation (e.g. research institute, government, private companies offering advisory services, or food processors). In this way, the personal motives and dispositions towards participating in the SFI might not always concur with the motives and dispositions of the organisation those individual actors are affiliated to. Specifically, as our

research suggests that farmers value the involvement of chain actors and other influential actors within agriculture in SFIs, we argue that research on those actors' agency to participate is equally interesting to investigate.

7.2.2 Reflection on our overall research approach

In the research approach of this dissertation, we made some specific choices that inevitably influenced the data we collected and the results we generated. The specific contribution and limitations of our choice to use multiple perspectives to investigate key dynamics related to participation in SFIs are already discussed in previous section 7.2.1. In the following sections we will focus on the choices we made regarding the subject of our research (SFIs), our choice for case study research and our data collection methods.

7.2.2.1 Specific focus on SFIs

By specifically focussing on initiatives that aim to support farmers in on-farm sustainable development, we brought together knowledge from a variety of fields that all can contribute to our understanding of SFIs, e.g., sustainability transitions, agricultural innovation systems and social and collaborative learning. Those fields of research do not necessarily investigate initiatives with this aim, or do even not involve farmers, but they showed similarities with SFIs on other regards, e.g. participatory processes, collaboration with a variety of actors, social learning on sustainability. This makes our research of particular relevance to organizations occupied with the extension and education of farmers or to other (existing or future) collaborations that aim to involve farmers in a joint sustainable development project. Hands-on conclusions and recommendations for SFI organizers resulting from this research are summarized in Chapter 8.

However, our decision to delineate the scope of our research to the dynamics at play related to participation in SFIs, also resulted in the limited attention to some dynamics that also might be import for the development of SFIs. As mentioned in section 7.2.1, our research does not go into detail on learning dynamics at the micro level (e.g., how exactly individuals learn while participating in SFI activities) or at the macro level (e.g., the interactions between the SFI and the broader context).

Further, we did not go into detail on one of the success factors of SFIs that we defined in Chapter 1, i.e., that successful SFIs should actually contribute to on-farm sustainable development. In this dissertation, we did not research the actual effect of participation on the on –farm sustainable development, i.e. the implementation and adoption of sustainable farming practices on the farm. We chose to leave this out of this research, because we argue that a farmer's decision to implement specific farming practices is likely

to be influenced by much more than merely the participation and learning in an SFI. Multiple authors argue that both factors linked to the farmer (e.g. knowledge, perceptions, skills, attitudes, age, dispositions, self-concept…) and external factors linked to the environment (e.g. societal, political, cultural, or geographical context) influence a farmer's behaviour to implement or adopt practices (Meijer *et al.*, 2014; Price and Leviston, 2014). Further, the farmers we interviewed who participated in our cases, were often also active in other study groups, politically engaged, or member of boards and farmer organizations. On this regard, Vandenabeele and Wildemeersch (2010) found that farmers' dispositions towards sustainable development are influenced by the diversity of networks they are involved in. Therefore, we argue that to understand the adoption and implementation of farming practices, research should have a much broader scope than merely the farmers' involvement and learning in SFIs. An interesting research question on this regard is: how are the farmers' dispositions towards sustainable development influenced by the networks they are involved in? Does this disposition influence the actual sustainable development on the farm (and what are other decisive factors)? Additionally, in the context of this research, an interesting question regards the contribution of participation in the SFI to the (changed) dispositions of farmers towards sustainability. Reimer *et al.* (2014) outlined an agenda for future research exploring conservation behaviours in agricultural systems and proposed four goals that are equally relevant for behaviour directed towards sustainable development on farms: (i) longitudinal research that couples biophysical research and social research to understand the drivers and impacts of farmer behaviours, (ii) the use of mixed methodologies, (iii) integrative interdisciplinary or transdisciplinary training of researchers combining social and natural sciences, (iv) focus on interactions between regulations, policies and programs that take a long-term view of addressing environmental problems and the activation of social values to support pro- conservation and pro-environmental dispositions amongst farmers.

7.2.2.2 Data collection method

Overall, data for this research was collected through document analysis, observations, a survey and interviews with organizers and participants in the SFI cases we used for our empirical research. This contributed to a rich set of data, but specifically the data collected through the survey and interviews might have been biased in three ways. First, we only interrogated actors who participated in the SFIs, and not those who left the SFI or do not participate. We can assume that farmers who are willing to participate in the SFI, show some interest in knowledge sharing or have a positive disposition towards the SFI's activities. This might have influenced our data. Indeed, our research offers little information on whether non-participating farmers prefer the same types of activities to learn on

sustainable farming. Another interesting perspective that is missing in my research are those farmers who stopped participating in the cases. However, we did not find any of them prepared to undertake an interview (e.g., in Beloftevol Boeren and DAIRYMAN –Flanders). For the reasons these farmers quit, we were dependent on the information given by the project coordinator and the other interviewed farmers. In this way, our results might be specifically relevant for those farmers who are inclined towards participation in an SFI, but might not necessarily be of relevance for farmers who dislike the idea of learning in SFIs.

Second, our data collected through interviews and the survey were highly dependent on those farmers who were willing to participate in our research. Specifically in the cases of Beloftevol boeren and DAIRYMAN- Northern Ireland, only a limited sample of farmers was willing to be interviewed. This might have biased our results, as it is likely that those farmers who participated in our research were more inclined towards the SFI. In DAIRYMAN-Flanders we were able to interview all participating farmers, except one who quit the project early. In Veldleeuwerik, we interviewed all farmers of one specific farmer group and observed two farmer groups with very divergent stances towards participation in Veldleeuwerik (one rather positive and one rather sceptic).

Third, our research did not go very much into detail on the type of actors that were interviewed or questioned. Indeed, not all actors of an actor group are the same. For example, farmers can have different farming styles, learning preferences, future perspectives. Similarly, neither advisors can be defined as a homogenous group of actors (see Klerkx and Proctor, 2013; Klerkx *et al*., 2017; Faure *et al*., 2012; Ingram, 2008; Vrain and Lovett, 2016; Ingram and Morris, 2007).

Another issue related to our data collection is the timing of our interviews and survey. The interviews were taken at one specific moment in time. As opinions can change, or answers might be influenced by specific recent events, this might be a weak point in the data collection strategy. However, as we always interviewed multiple respondents this bias was weakened. Further, respondents sometimes had to recall events from up to ten years after their occurrence. This might have resulted in less detailed information on specific events, e.g., for the reconstruction of the early period of the SFI's developmental history.

7.2.2.3 Choice for case-study research

In this research, we investigated participation and learning in three real-life cases of sustainable farming initiatives (Chapter 4 to 6) and a case of the development of a sustainability assessment tool. In this way our research contributed to the in-depth research on initiatives that aim to support on-farm sustainable development by actively engaging farmers in a learning process. We therefore used an interesting mix of cases: an enduring

and established case (Veldleeuwerik), a case with a lot of potential to contribute to knowledge creation on sustainable development on farms, but missing enduring financial support (DAIRYMAN), a case that faced lots of difficulties to develop and eventually phased out (Beloftevol Boeren), and our scene setting case (the development of MOTIFS) which resulted from the failed adoption of a sustainability assessment tool. This is a rather limited sample of cases to generalize findings. However, using the different theoretical perspectives, we were able to come to interesting indications on relevant dynamics related to participation in these SFIs. Further, each case also had its own initial objective, that influenced the role divisions, task, tools used and rules, and takes these historical decisions with it (see also Chapter 6), which might make it difficult to compare the SFIs. However, we used this critique as a strength to understand how these historical decisions cause change in the SFI's objective or impede change when they cause a lock-in.

7.2.3 Suggestions for further research on sustainable farming initiatives

Our research endeavoured to build a rich picture of the dynamics related to farmer participation and learning in sustainable farming initiatives. As reflected section 7.1, this provided us with interesting insights, but it also revealed new questions and knowledge gaps. Our research specifically points at four main knowledge gaps. The first gap refers to the influence of the broader societal, political and cultural context on the performance of the activities in the initiatives, and vice versa, how the outcomes of the learning processes in the initiatives penetrate into the broader societal context. The second gap, refers to how participants learn while participating in the initiatives, i.e. the discursive processes that define the farmers' learning process. The third gap questions the required dispositions and competencies of the actors engaged in the initiatives. The fourth gap regards the influence of farmer participation in SFIs on the actual implementation and adoption of sustainable farming practices on the farm. A farmer's decision to implement specific farming practices is likely to be influenced by much more than merely the participation and learning in an SFI. To answer this knowledge gap, research should have a much broader scope than merely the farmers' involvement and learning in SFIs.

So, although the multiple perspectives used in this research provided a rich picture on the dynamics related to farmer participation in SFIs, it certainly stirred up our eagerness to further explore dynamics on the actor and institutional level of the SFIs.

CHAPTER 8.
Recommendations for initiators of sustainable farming initiatives

In this research, we aimed to scrutinize key characteristics of SFI design that can facilitate the participation and learning of farmers within an SFI, by investigating the relevant dynamics at play. To uncover these dynamics, we first answered three specific research questions regarding the motivation of farmers to participate in an SFI, the design characteristics contributing to value creation for farmers, and the organizational dynamics contributing to the development of an established SFI. We answered these questions performing empirical research on three SFI cases (Veldleeuwerik, Beloftevol Boeren and DAIRYMAN) using three different theoretical perspectives (self-determination theory, communities of practice, and cultural-historical activity theory). In Chapter 7, we articulated the findings from this empirical research using a practice-based perspective. This enabled us to reveal key dynamics and characteristics that favour farmer participation and learning in an SFI. In this final Chapter, we draw upon this Chapter 7 to translate our results into practical take home messages for actors involved in the design and development of SFIs.

8.1 Attracting farmers and stimulating active participation

We found that farmers' motives to participate in an SFI are diverse, manifold and differ in quality. Our research indicated that those characteristics of the initiative that are appropriate to attract farmers, are not necessarily the same as those that successfully maintain persistent participation.

Use incentives to attract farmers who are not inherently motivated to participate in an initiative

Not all farmers immediately recognize the value of participating in a social learning process on sustainable farming, for example, because they do not perceive sustainable development as a primary concern. To also attract those farmers to participate in the initiative, other incentives than merely learning on sustainable development should be addressed. Our research showed that farmers also participated for reasons like knowledge exchange, social contact or business opportunities. Further, also nudges like rewards or social pressure, can help to attract farmers. Examples from our cases of such nudges are exemption on the regulations of the EU common agricultural policy, financial surplus on products of participating farmers, product labels that prove the farmers' participation in the

initiative towards consumers, sustainability certificates, offering grants for investments, social pressure from processors or retail to whom the farmers deliver their products. However, such nudges do not guarantee engaged participation in the activities of the initiative. This requires other characteristics.

Create an environment that contributes to the satisfaction of farmers' basic needs

To increase the engagement and performance of the farmers who participate in the initiative, the initiative should provide an environment that contributes to the farmers' satisfaction of the psychological basic needs of autonomy, relatedness and competence. The satisfaction of these basic needs contributes to the farmers' personal endorsement and a feeling of freedom of choice regarding their participation. Such a higher quality motivation is related to more persistent farmer participation and deeper learning. Initiatives can contribute to the satisfaction of these basic needs by offering an environment that is autonomy supportive to increase the farmers' feeling of control and volition of their own behaviour, well-structured to increase the feeling of competence and efficacy in the activities of the initiative, and warm and supportive to increase the feeling of relatedness to important others within the initiative (Ryan and Deci, 2000a; Vansteenkiste, Niemiec and Soenens, 2010).

Our cases deliver inspiration on how to provide such a basic need supporting environment in the initiative. Our research shows that the regional farmer group meetings, in which farmers discuss their sustainable development plans with peers, and the support for personal goal achievement within the initiative contribute to the satisfaction of all three basic needs. Further, the initiative can contribute to autonomy support by providing decision-making power to the farmers both on their farm (e.g., by providing flexibility in the measures for on-farm sustainable development), and within the initiative (e.g., by using a bottom-up organizational approach for making important decisions on the future development of the initiative). Further, also limiting controlling evaluation, deadlines and rules, or the provision of rationales for imposed participation rules contribute to an autonomy supportive environment.

Competence support can be provided through knowledge exchange on sustainable development on farms, thus contributing to the farmers' mastery on what sustainable development on their farm can entail. This can be provided through the organization of (i) reflection activities on how exactly sustainability is interpreted in the initiative, (ii) support in knowledge creation on their own farming system, (iii) feedback on progress made in the on-farm sustainable development, (iv) encounters with farm advisors. Further, the provision of a structured approach on how sustainable development on farms can be operationalized

can contribute to the farmers' feeling of competence and efficacy in the initiative's activities. For example, Veldleeuwerik provides a systematic approach that comprises the draft of a sustainability plan using ten sustainability indicators, frequent discussions in farmer group meetings and frequent knowledge exchange with chain actors. Further, also sufficient degrees of flexibility that allow to align the farmers' participation in the SFI with their on-farm activities can contribute to the feeling of competence.

Relatedness support is enhanced by frequent interactions and group encounters with significant others, like peers, chain actors, researchers or advisors, in which experiences and knowledge is shared and cooperation is stimulated. The feeling of relatedness benefits from a community that is open, trustful, respectful, and based on equal positions between actors. The organisation of frequent group activities based on sharing of knowledge and experiences contributes to this.

8.2 Creating a rich value pallette for farmers

Participation in an initiative can create different types of value for farmers, for example, immediate value related to the participation in the activities, potential value that might be of use later, value that can be applied and results in benefits for the farmers, or value that contributes to changed goals and understandings of what matters. Our research indicates two different types of activities that differently contribute to the creation of these value types: group and individual farmer activities. In order to create a diverse value pallette for farmers, we argue that both types of activities should be complementary provided in an initiative.

Organize group activities for knowledge creation on sustainable development …

Group activities entail the exchange, creation and negotiation of non-farm specific knowledge on sustainable development between farmers and other actors. These processes can be present in activities that are specifically organized to facilitate farmer learning on sustainable development or in activities that are related to the development and organization of the initiative. Our cases show that multiple actor types can contribute to these group activities, e.g., farmers, researchers, experts on a specific sustainability topic, farm advisors, chain actors, or members of the daily management of the initiative. For example, in DAIRYMAN, farmers provided data to researchers, who analyzed them to find generalizable patterns, that were fed back to a group of farmers. Or, in Veldleeuwerik, knowledge and experience sharing between farmers mutually, or between farmers, chain actors, advisory services or experts, are set up to generate insights on diverse sustainability topics.

Although multiple combinations of actor types can be involved in these group activities, our cases show the recurrence of specific roles, i.e., expert roles, facilitator roles, co-creator roles, and translator roles. These roles can be taken up by different kinds of actors, but require specific competencies. For example, facilitators, who facilitate the group activities and knowledge exchange, preferably have a good knowledge of farming practices to steer the knowledge co-creation process. Knowledge co-creators are actors other than farmers, who co-create knowledge together with farmers. They preferably have a specific disposition towards the equal inclusion of farmers as a valuable source of knowledge, but they also have to proficiently feedback their findings towards farmers to create an ongoing process of knowledge creation. The translator role was in our cases mostly performed by farm advisors, who translated knowledge provided by researchers or technical experts into practical information for farmers. Further, tools that visualize the initiative's perspective on sustainable development can aid to further develop and disseminate the knowledge generated on sustainable farming in the group activities.

… and set up individual farmer activities to generate farm specific knowledge

Our research shows that farmers show a high interest in farm specific knowledge, that is directly relevant and/or applicable on their farm. Besides setting up group activities, we thus advise to also set up activities that contribute to knowledge creation for a specific farm. In our cases this was operationalized in several ways. For example, sustainable development plans for a specific farm are drafted by a farmer and farm advisor, or research is performed on the farm in close collaboration with the farmer and is fed back to the farmer in the form of specific advice with the aid of an advisor, or group discussions on the sustainability plan of one farmer are organized and provide specific input for issues this farmer is experiencing.

Although also in the individual farmer activity different types of actors can be involved, our research stresses the crucial role of farm advisors as translator of knowledge into farm-specific applicable knowledge. These are preferably competent in communicating, empathizing and listening, being impartial, technically capable, and valuing farmers' insights (Ingram, 2008). Further, tools can be used to provide and create farm specific knowledge. In our cases, sustainability assessment tools and farm development plans were used as a guide to define the topics on which knowledge is to be created or provided, and practical tools such as maps were used to enable an easy interpretation of on-farm research results.

Provide first-hand experiences on real-life locations for farmers

Our research confirms that farmers attribute great value to activities that provide first-hand and real-life experiences. This holds both for knowledge shared between farmers and between farmers and other actor types. Examples where such an experience is provided

are visits, demonstrations and workshops on farms, sites of chain actors, experimental farms, or field trials.

8.3 Learning on sustainable development at two levels

Our research shows that learning on sustainable development takes place at two levels: at the level of the farmer and at the level of the initiative while discussing, negotiating and practicing the farmer learning activities. First, the learning at farmer level results from the activities that are organized with the specific aim to support farmer learning on sustainable farming. These can be both individual farmer and group activities. Second, also the initiative learns on sustainable farming and learning. Different activities contribute to this learning at the level of the initiative: (i) the creation of a shared vision, goals and approach to support farmer learning on sustainable farming at the outset of the initiative, (ii) the implementation and performance of this approach, (iii) the frictions that emerge from this implementation, (iv) the growing insights on why these frictions emerge, and (v) the re-negotiating and adjustment of the initiative's perspective on farmer learning and sustainable development. This description shows that the continuous performance and outcomes of farmer learning activities also contribute to insights on sustainable farming and farmer learning at the level of the initiative. After renegotiating new perspectives and adjusting farmer learning approaches on sustainable farming this is fed back into the farmer learning activities.

This shows that the processes that actually support farmer learning on on-farm sustainable development and the learning processes at the level of the initiative are inseparably connected to each other, and both deserve equal attention in the design of initiatives. Further, it also shows that the learning process on sustainable development already starts from the outset of the initiative, when a mutual perspective on sustainable development and farmer learning is negotiated between the actors involved. This advocates for the involvement of farmers in this learning process at the level of the initiative.

Stimulate farmer involvement in the development and learning processes at the level of the initiative

In practice, our cases show that the interrelation between both types of learning processes can be supported. First, a bottom-up approach for internal decision making at the level of the initiative can be created. For example, Veldleeuwerik exists of multiple governance bodies to capture the concerns of different types of actors (e.g., farmers, farmer group facilitators, chain actors) within the initiative, and through which pending decisions regarding the initiative's governance are negotiated with all the participants. Second, knowledge and insights can be disseminated throughout the initiative, for example, through the use of

newsletters, reports, websites, conferences and participant meetings. Third, for the learning processes to take place, sufficient time, frequent (group) activities, and informal interactions are needed to create mutual trust and engagement of farmers and other actors involved. Building the community on pre-existing relationships can speed up this process.

8.4 Stakeholder representation and involvement.

Our research shows that initiatives benefit from stakeholder involvement in two ways. First, a representation of relevant actor groups from the agri-food system in the initiative's community contributes to the learning at the level of the initiative (see previous key message). Second, stakeholder involvement contributes to the embedding and alignment of the initiative's procedures with practices and procedures in the agri-food system. This contributes to the engagement of farmers in the initiative.

Involve a broad diversity of stakeholders from the start and also within the governing bodies of the SFI

Our cases show that to involve stakeholders in the initiative's governance structure, they are preferably already involved from the very start, when shared visions and goals for the initiative are starting to be developed. For example, in the Veldleeuwerik case, the limited knowledge of both farmers and a brewery on what sustainable barley could entail, resulted in a gradual and joint learning process and meaning making of what sustainability should entail in arable farming. Further, the involvement of actors who are financially strong (e.g., food processors), can contribute to the initiative's self-support and independence from external financing.

Actors with a broad and diverse network within the agri-food system can aid in this process of physical community building. They can use their connections to stimulate actors to participate or to connect different types of actors. Further, the Veldleeuwerik case indicates that the diversity of actors participating in the initiative is preferably represented in the governing bodies of the initiative.

Organize encounters between the SFI and a wider stakeholder group of actors to align and embed the initiative in the agri-food system.

The alignment and embedding of the initiative in the agri-food system benefits from regular dissemination of the initiative's activities and outcomes towards a wider stakeholder group of actors who do not participate in the initiative, but do have an influence on farm activities. In our cases, this was performed through the dissemination of newsletters or the organization of a conference. Additionally, regular consultation moments in which feedback is asked on the initiative's governance from important actors in society and the agri-food

system contributes to the further alignment and embedding of the initiative. This also allows to take into account changing discourses and expectations in society and the agri-food system. For example, Veldleeuwerik organizes conferences and an advisory board as a governance body in its governance structure. This board includes representatives from society, such as farmers' unions, environmental organizations, education and science, and regional water authorities, to evaluate the performance and governance of the initiative.

By putting forward these practical take home messages, we hope that this research will be a source of inspiration equally for researchers and actors involved in the development of sustainable farming initiatives. We hope that implementation of these recommendations and the subsequent feedback can contribute to the further understanding on how to support farmers in the sustainable development of their farms.

CHAPTER 9. References

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Icons used in this dissertation

Human agency, based on Elizabeth Lopez from Noun Project

Routinized activities, based on Kamal from Noun Project

Socio-cultural structure, based on Wireform from Noun Project

Material-functional structure, based on Creaticca Creative Agency from Noun Project

Annex

Annex 1. Interview Guide: Reflection on development process of MOTIFS

This annex contains the interview guide we used for data collection of the research performed in Chapter 3, on the development process of MOTIFS.

First, questions were asked about the involvement in the research on sustainable agrictulture in Flanders.

- How did you become familiar with the research on sustainable agriculture in Flanders?
- How was the assignment of STEDULA developed? What was this assignment?
    - What was STEDULA's vision and mission?
    - What was your role in STEDULA?

Second, our questions focussed on the development process of MOTIFS.

- How did the idea to develop the sustainability assessment tool MOTIFS grow?
- What was the rationale behind the design of MOTIFS?
- How was research on MOTIFS organized and performed?
    - Did you use specific methods or approaches?
- How would you describe MOTIFS' objective and its functionalities?
    - Did the initial objective of MOTIFS change during the course of its development?
    - In your opinion, where the objectives reached?
- What are, according to you, the weak and strong points of MOTIFS?
- What were the expectations of the researchers regarding MOTIFS?
    - Were these expectations met?
    - Did these expectations change?
    - Where your expectations met and/or did they change during the course of the development?
- Who were defined as the stakeholders of MOTIFS?
    - How did they respond on the development of MOTIFS?
    - What did they expect of the development of MOTIFS?
    - Which stakeholders were not involved (enough) according to you?
- How was the development of the individual sustainability indicators of the MOTIFS tool organized?
    - Was there a general approach for all indicators?
    - Did you experience difficulties in the development process?

- At a given moment in time, the development of MOTIFS stranded.
    - What went wrong according to you?
    - Could you indicate specific factors/reasons?
- How was the implementation of MOTIFS in practice organized?
    - Did you experience specific difficulties during this process?
    - What was the reaction of the stakeholders during the implementation?
- What did we learn (both positive and negative experiences) from the development of MOTIFS?
    - What can be of use in future research?
- How score MOTIFS in comparison to other sustainability assessment tools?
    - Do they have similar problems?
    - Do they use other methods or discourses?

Third, we asked questions on the interviewee's vision and expectations on sustainable development.

- What does "sustainability" mean to you?
- What does "sustainable agriculture" mean to you? At farm level and sector level.
- How can agriculture sustainably develop according to you?
    - Which role do the different actors and stakeholder have in this?
- Are you familiar with sustainability assessment?
    - Are you familiar with the multiplicity of existing tools and systems?
    - Do they satisfy for the purpose of sustainable development in agriculture according to you?
- What would you expect from a sustainability assessment tool as an end user?
    - What should it be capable of according to you? (e.g. monitoring, sensitizing, awareness creation)
    - Does a tool require different functions for other end users or levels (e.g. farm level, sector level)?
- Do you know what the expectations are of the end users of sustainability assessment tools?
- How can research support these processes of sustainable development and sustainability assessment in agriculture according to you?
- What is the future for research regarding sustainability and sustainable development according to you?
    - What are priorities according to you?

Annex 2. Interview Guide: Value creation in DAIRYMAN

This annex contains the interview guides we used for data collection of the research performed in Chapter 5, on value creation from a farmers' perspective during participation the DAIRYMAN project.

We questioned the perceived value creation by the farmers during their participation in DAIRYMAN, using the five value types as developed by Wenger *et al*. (2011).

Immediate Value

- Looking back at the DAIRYMAN project, what do you remember best?
    - Why do you specifically have these memories?
    - What was their relevance for you as a dairy farmer? And as a person?
    - Who was involved in these memories?
- With whom did you have the most or best interaction and connection (names/stakeholder types)?
    - Which persons where indispensable in the project according to you?
    - Which of these interactions or connections did influence you the most?
    - Specifically, how did you experience the relationship with the researchers?
- What was your position in the project?
    - Did you have a strong feeling of involvement?
    - Did you have the feeling of being part of a DAIRYMAN network?
    - Were you able to give input? An was this input acknowledged?
    - Did you have the feeling of being an important actor in the network?

Potential value

- There are several potentially valuable effects by participating in these types of projects: what would you consider to be the most valuable effect of participating in DAIRYMAN?
    - Did you gain new knowledge, skills or techniques?
    - Did you gain insights in other perspectives on dairy farming, and on the work you perform?
    - Did your participation yield net contacts or an improved network?
        - Which new persons did you meet?
        - Would you contact them when you have a question?
        - Can you trust them?
    - Are there other advantages linked to your participation?

Applied value

- Have you applied or made use of these new knowledge and connections you have gained by participating in DAIRYMAN?
- Was there information (reports, documents, etc.) provided to you by the project that you have used?

(When the response to these questions was yes, we asked deeper questions to gain information on the realized value)

Realized value

- Have you made any changes on your farm or personally, inspired by participating in the project?
- If yes, how did it work out?

Reframing value

- When reflecting on your situation, and dairy farming in particular here in Northern-Ireland/Flanders and Europe, what is important for you? What are your main drivers in your profession?
- What were then your motivations to participate in the Dairyman project? How did you get involved, and what were your initial expectations?
- Given that DAIRYMAN was a project about sustainable dairy farming: what does sustainability or sustainable dairy farming mean to you? Does it play a role in your day to day farming practices?
- Has your participation in DAIRYMAN changed any of your perspectives, either on your situation, main drivers, your farm management, dairy farming or sustainability in general?

We ended the interview with some concluding reflections on the DAIRYMAN project

- Overall, how would you describe your experiences of participation in DAIRYMAN?
- Did the project meet your expectations?
- What was successful and/or positive about the project?
- What did you experience as not successful and/or negative?
- Would you participate in similar projects? Why? What would determine your decision?

Annex 3. Interview Guide: SFI development using CHAT

This annex contains the interview guides we used for data collection of the research performed in Chapter 6. We used two guides: one for members of the organization of Beloftevol Boeren or Veldleeuwerik and one for the farmers. In the interview guides Beloftevol Boeren and Veldleeuwerik are referred to as 'the initiative'. This questions displayed below should be interpreted as a guide and not a fixed checklist that had to be followed. Depending on how the interviewees answered and how the interview advanced, the order of the questions or the way they were formulated could change.

1. Interview guide for organization members

The interview guide comprises questions on three developmental processes of the cases: the foundation of the SFI, development of the processes and tools supporting on-farm sustainable development, and implementation of these processes and tools. So, for each interviewee we customized a the set of questions, dependent on the development processes he or she was involved in.

1. Getting acquainted

Subject	- Since when are you involved in the initiative? - How did you become acquainted with the initiative? - How would you describe your role and function in the initiative? - Are you affiliated to a company? What is your function in this company? - Were you involved in the development of the initiative's method for farmer support on sustainable development?

2. Questions on the foundation or the start of the initiative.

Timeline	- When did the initiative start?
Subject, division of labour	- Where you involved from the very start of the initiative? - What was your role in it?
Motivation	- What was the overall motivation to start with the initiative? - What was your motivation to participate in it? - Who was mostly motivated to start and give a chance to the development of the initiative?
Object	- How would you describe the main goals at the start of the initiative? Who did the organizers want to reach with the initiative?

Tools	- How was the outset of the initiative organized? Were specific instruments, tools or guidelines used to successfully develop the initiative?
Community	- Who else was involved?
Division of labour	- What was their role at the outset of the initiative ?
Rules	- Were their specific conditions directed from society or participating companies that had to be taken into account?

2. Questions on the development of the initiative's method for farmer support on sustainable development

Subject, division of labour	- What was your role in the development of the method?
Object	- What was your initial idea about the final design of the method? - How would you describe the current objective of the method? - How would you describe the current method? What are its basic principles? Are specific tools used to support the method? What type of meetings are organized? - How is the whole initiative organized? What are the functions of the different boards? - Did the method evolve since you started participating in the initiative? How were decisions made to change the method? How are changes communicated towards participants? - Which conditions and engagement is required of farmers and chain actors to participate in the method?
Tools	- How was the development of the method operationalized? Was there a predefined approach or did it develop rather organically?
Community	- Who was involved in the development of the method?
Division of labour	- What was their role?
Rules	- Were there conditions to take into account for the development of the method? Were there pre- imposed demands or rules?

3. Questions on the rollout and implementation of the method in practice.

Timeline	- When did the implementation of the method start? Was the method fully developed at that time or was it still under construction?
Subject, division of labour	- Are you involved in the implementation of the method? - What is your role?
Object	- What were the objectives/ambitions related to the rollout of the method at the start? Who did you want to reach? - Did you make any progress in meeting these objectives? - How would you describe the current objectives of the initiative? - How would you describe the process of rolling out the method? Did you experience it as easy or rather difficult? - Do you think the objective of the initiative changed during its existence? How and why? - What are the most important changes, adjustments or refinements made on the method? - How did the number of participants evolve? - Are there future changes or developments planned?
Tools	- How was the rollout of the method operationalized? - How do you operationalize your role in the method? - How is progress monitored on this regard?
Community	- Who was/is involved in the implementation of the method?
Division of labour	- What is their role? - How do they influence your tasks? - How do you experience collaborating with other actors in the initiative? - How do you experience your involvement in the organization of the initiative?
Rules	- Do you think that specific discourses or developments in society and the agro-food system influence the implementation of the method? - Do you think that the actors involved in the rollout require specific competencies and attitudes? Do they have to meet specific conditions or share a specific vision?
Reflection	The initiative aims at sustainable development in agriculture. - What does sustainability mean to you?

	- Did your interpretation of what sustainability means change during your involvement in the project? If yes, how did that happen? Is this also expressed in your behaviour? - How does the initiative contribute to sustainable development according to you? Participants in initiatives often claim that they want to learn by participating. - What does "learning" mean to you? - What motivates you to learn? - What is the role of learning in the initiative according to you? - Was this role of learning consciously taken into account during the development of the method? - Did your opinion about the importance of learning for sustainable development change during your participation in the initiative? - Does/Did participating in the initiative create added value to you? How? - Do you think you learn(d) from participating in the initiative? How important is this learning to you? Reflecting on the development and implementation of the method: - Did you learn during these processes? And did the organization learn? - How did farmers react on the method? What were there expectations? - What were your initial expectations of the implementation of the method? Are they changed throughout the years? - What are bottlenecks in the initiative according to you? What are successes? - When do you consider the initiative as succeeded? Did it already succeed? - Did farmers stop participating in the initiative? Why? - According to you, do farmers need an initiative like the one you participate in to sustainably develop their farming practices?

2. Interview guide for the farmers

Subject	- First, can you describe your farm to me? - Why did you become a farmer? - Since when are you the manager of this farm? - Who else works on your farm? - Are you involved in other activities besides your farming business? - What do you deem important in farm management?
Timeline	- When did you start participating in the initiative?
Object/Motive	- Why have you decided to participate in the initiative?

	- What were your expectations regarding what your participation would yield for you? - How would you describe the objective of the initiative?
Tools	- How did you get acquainted with the initiative? - Can you explain me what the procedures and activities are in the initiative? - How do you learn about farm management and adopting farm management practices? - What or who are your learning sources within the initiative? Are there, besides the initiative, other learning sources? - How do you make decisions in your farming management?
Rules	- Do you have to meet conditions to participate in the initiative?
Community	- Who influences your decisions to sustainably develop your farm the most within the initiative? How? - How do you experience your relations with other actors within the initiative?
Divisions of labour	- How would you describe the role divisions within the initiative? - How would you describe your own role?
Reflection	Participants in initiatives often claim that they want to learn by participating. - What does 'learning' mean to you? - What motivates you to learn? - What is the role of learning in the initiative according to you? - Does participating in the initiative create added value to you? How? - Do you believe that you learn from participating in the initiative? - How important is this learning to you? The initiative aims at sustainable development in agriculture. - What does sustainability mean to you? - Did your interpretation of what sustainability means change during your involvement in the initiative? If yes, how did that happen? Is this also expressed in your behaviour? - How does the initiative contribute to sustainable development according to you? - Did your opinion about the importance of learning for sustainable development change during your participation in the initiative? - What is your opinion on how the initiative works/performs? What works well? What are bottlenecks? - Which changes in your farm management have you considered and/or implemented based on your participation in the initiative? Why? How did you make those decisions? - Do you think you would have made those changes without participating in the initiative?

- According to you, in general, do farmers need an initiative like the one you participate in to sustainably develop their farming practices?

Annex 4. Curriculum Vitae

Personal information

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2012-2018: PhD in Bioscience Engineering

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2010: Certificate Project Management Program A: working in a project environment

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2005-2007: Master in environmental management and sanitation

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1995-1997: Latin

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Scientific publications in journals with peer review

Triste, L., Debruyne, L., Vandenabeele, J., Marchand, F., & Lauwers, L., 2018. Communities of practice for knowledge co-creation on sustainable dairy farming: features for value creation for farmers. Sustainability Science, pp. 1-16. https://doi.org/10.1007/s11625-018-0554-5

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Oral presentations at international conferences

Triste, L., Vandenabeele, J., Coteur, I., Cooreman, H., & Marchand, F., 2017. Investigating Features of Chain-wide Sustainability Initiatives Favouring Sustainable Development in Flemish Agriculture. Oral presentation at the 23nd European Seminar on Extension and Education (ESEE), 4th – 7th July 2017, Chania, Greece.

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Triste, L., Debruyne, L., & Marchand, F., 2016. Agroecology in farmer education in Flanders: a survey. Oral presentation at the 5th Belgian Agroecology Meeting (BAM2016), 20 September 2017, Ghent, Belgium

Triste, L., Marchand, F., Vandenabeele, J., Debruyne, L., & Lauwers, L., 2016. Elaborating hypotheses on motivations for participation in cooperation initiatives for sustainable farming. Oral presentation at the 12th IFSA Symposium, 12- 15 July 2016, Newport, Shropshire, United Kingdom.

Triste, L., Marchand, F., Vandenabeele, J., Debruyne, L., & Lauwers L., 2015. Using CHAT in the search for a meaningful future: the case of a Flemish initiative for sustainable farming. Oral presentation at the 22nd European Seminar on Extension and Education (ESEE), 28 -30 April 2015, Wageningen, Nederland.

Pereira-Querol, M., Vänninen, I., & Triste, L., 2015. Learning and transforming with cultural historical activity theory : key concepts. Oral presentation at the 22nd European Seminar on Extension and Education (ESEE), 28 -30 April 2015, Wageningen, Nederland.

Triste, L., Marchand, F., Vandenabeele, J., Debruyne, L., Coteur, I., & Lauwers, L., 2014. Approaching initiatives stimulating sustainable farming as characteristics of learning practices. Oral Presentation at the 11th European IFSA Symposium, Berlin, 1-4 April 2014, Farming systems facing global challenges: Capacities and strategies

Triste, L., Debruyne, L., & Marchand, F., 2013. The influence of regional actors on the success of an interregional learning and innovation network for sustainable agriculture. Oral presentation at the XXVth ESRS Congress, 29 July – 1 August 2013, Florence, Italy, Rural resilience and vulnerability: The rural as locus of solidarity and conflict in times of crisis

Scientific reports

Triste, L., Debruyne, L., Wustenberghs, H., Mazijn, B., & Marchand, F., 2017. Agro-ecologie in land- en tuinbouweducatie: Verkenning van de situatie in Vlaanderen. Merelbeke: Instituut voor Landbouw-, Visserij- en Voedingsonderzoek.

Triste, L, Debruyne, L, & Marchand, F, 2013. Duurzame landbouw: een proces van leren. ILVO-mededeling Nummer 124. Merelbeke. Instituut voor Landbouw-, Visserij- en Voedingsonderzoek.

Other relevant courses and activities

Attendance of summer schools and conferences

PhD Course: IFSA Systems Thinking in Practice (STiP) in PhD Research, 10th of July 2016 – 16th of July 2016.

Beneluxconferentie: Leren in Transitie, Ghent, Organized by: Departement Leefmilieu, Natuur en Energie, 18th of November 2014 – 20th November 2014

Summerschools Let's talk science!, Summerschool science communication. Brussels. Organized by Ghent University, University of Antwerp, University of Hasselt, University of Leuven, and Vrije Universiteit Brussel. 2nd of July 2014 – 4th of July 2014

Courses

Onderwijs in relatie tot samenleving en cultuur, KULeuven, Faculty of Psychology and Educational Sciences, Prof. Maarten Simons, 29th of September 2014 – 31st of January 2015.

Advanced Academic English: Writing Skills, UGent, 11th of February 2014 – 26th of May 2014.

Nvivo 10, UGent, 23th of May 2013 – 24th of May 2013.