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DOI
10.4233/uuid:e5b8e199-a34c-4cb1-b8bb-836218b12e77

Publication date
2021

Document Version
Final published version

Citation (APA)
Kusnandar, K. (2021). *Empowering stakeholders to organise their agricultural production and supply chains for a sustainable and inclusive future in Indonesia*. [Dissertation (TU Delft), Delft University of Technology]. https://doi.org/10.4233/uuid:e5b8e199-a34c-4cb1-b8bb-836218b12e77

Important note
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Please check the document version above.

Empowering stakeholders to organise their agricultural production and supply chains for a sustainable and inclusive future in Indonesia

K. Kusnandar

EMPOWERING STAKEHOLDERS TO ORGANISE THEIR AGRICULTURAL PRODUCTION AND SUPPLY CHAINS FOR A SUSTAINABLE AND INCLUSIVE FUTURE IN INDONESIA

EMPOWERING STAKEHOLDERS TO ORGANISE THEIR AGRICULTURAL PRODUCTION AND SUPPLY CHAINS FOR A SUSTAINABLE AND INCLUSIVE FUTURE IN INDONESIA

Dissertation

for the purpose of obtaining the degree of doctor
at Delft University of Technology,
by the authority of the Rector Magnificus prof. dr. ir. T.H.J.J. van der Hagen,
Chair of the Board for Doctorates
to be defended publicly on
Friday 5 February 2021 at 12.30 o'clock

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This research has been funded by the Ministry of Research and Technology of the Republic of Indonesia through the programe of RISET-Pro

Case studies in this research have been supported by the Study Programme of Agribusiness Faculty of Agriculture, Universitas Padjadjaran, Indonesia

Email: kussrai@gmail.com
Cover design by K. Kusnandar and Geertje Slingerland
Printed by IPSKAMP
ISBN: 978-94-6366-363-2
An electronic version of this dissertation is available at http://repository.tudelft.nl/

ACKNOWLEDGEMENTS

It was about five and half years ago when I first flew from Indonesia to the Netherlands to start my PhD journey at the Systems Engineering Section in the Faculty of Technology and Policy Management, TU Delft. During this journey, I have experienced and learned many invaluable things in my life. I would like to express my gratitude to all of you who have contributed to this great achievement.

First and foremost, I would like to express my gratitude to my promotors, Frances Brazier and Olaf van Kooten, for all time and energy they have spent to support me to get through this process. New perspectives and knowledge of doing research have been gained during discussions with Frances and Olaf. Writing academic articles collaboratively with them has improved not only my writing skills but also my critical thinking. Their critique was always sharp, but in the end, it resulted in very wonderful outputs that I had not imagined before. On top of that, they always pay attention to my life situation, apart from the PhD process itself. Thank you very much.

During my PhD, I was lucky to join a section filled with very wonderful people who always support and help each other, the Systems Engineering Section. Martijn Warnier, thank you for always making people in our section connected, and always willing to give feedback to our works. Sander van Splunter, thank you for supervising me during the first eight months of my PhD. Geertje, thank you for your supports and helps, especially for the willingness to be the paranymph of my defence (even though it was cancelled due to the Covid-19 rules), for designing the book cover, and also for editing the Dutch version of this thesis' summary and proposition. Xavier, Chen&Yi, Darya, Marina, Indushree, Vittorio, and Rado, we used to cook and have lunch/dinner and hanging out together (before the Covid-19 pandemic), thank you for those wonderful times. My officemates: Vassiliki, Angelo, and Marinus, whom I really enjoyed chatting and having coffee-talks with. I would also like to thank Yillin, Supriya, Esther, Everdine, Wendela, Isabelle, Iulia, Pinar, Ali Reza, Nina, Selma, Emma, Justina, Nazli, Igor, and Natalie for all supports. In addition to this section, during the first two years of my PhD, I joined the peer group called The Day After Tomorrow. Baiba, Grace, Vassiliki, Ozge, thank you very much for the monthly discussion. I learned a lot from this activity.

As part of my PhD programme, there were fieldworks supported by Padjadjaran University, Indonesia (Unpad). For this, I would like to express my gratitude to Tomy Perdana who coordinated his team to support the fieldworks, and always willing to help when needed. I would also like to thank the facilitator team from Unpad: Tetep, Ajeng, Fernianda, Anggita, Rahmat, Sony, Syifa, Pieceli, Azka, Arfina, Mahra, Yantus, and Daryl for making the filedworks successful.

During my PhD journey, I made new friends who some of them become really close friends. The Retjeh: Kartika, Retna, Bramka, Nabriz, Aldy, Bita, and Antra, thank you for all the wonderful memories we have created, you are all my new family. Mirthe and Hao Yuan, I really enjoyed going out with you. I would also like to thank the Indonesian com-

munity in Delft, especially Etty, Agung, Dhata, Liza, Rizal, Luthfi, Songko, Bella, Budi, Aries, Ayu, and outside Delft, especially Yudha (Wageningen) and Biansy (Rotterdam) for making my PhD journey even more colourful.

My PhD programme was also supported by the Research Center for Science and Technology Policy and Management, Indonesian Institute of Sciences (P2KMI-LIPI). For this I would like to thank the Head of P2KMI-LIPI, Dudi Hidayat, and his predecessors Chichi Shintia Laksani, Trina Fizzanty, and Husein Avicena Akil. I would also like to thank my colleagues at P2KMI-LIPI who always helped and supported me, especially Purnama, Karlina, Irene, and Galuh.

Last but not least, I would like to deeply thank my mom and my sister for sacrifices they made to enable me to get access to education. I would also like to thank all Encoh's family for all supports you have given to me.

Kusnandar
Delft, December 2020

CONTENTS

1

INTRODUCTION

The United Nation's 2030 Agenda for Sustainable Development, adopted in 2015, defines 17 Sustainability Development Goals (SDGs) for environmental, economic and social development [1].

One of the critical sectors in the SDGs is Agriculture (Kanter *et al.*, 2016) as explicitly stated in SDG 2: "End hunger, achieve food security and nutrition, and promote sustainable agriculture". With respect to promoting sustainable agriculture, SDG 2 emphasizes the importance of empowerment of smallholder farmers in developing countries (Terlau *et al.*, 2019).

One of the essential conditions for sustainable agriculture is participation of not just smallholder farmers but also other actors (Munier, 2005) as recognised in the SDGs (Kanter *et al.*, 2016; UN Environment, 2019). As actors' decisions and actions are affected by and affect other actors in agricultural production and supply chains (APSCs) (Matheis and Herzig, 2019), all actors need to be involved to achieve this goal. Although not explicitly stated in the SDG 2, participation is an implicit requirement for SDG 2.4 and 2.C to acquire sustainable food production systems (i.e. increasing productivity while maintaining the ecosystem) and market conditions (i.e. sustainable markets, access to market information, and dealing with price volatility) [2].

To support participation of actors in APSCs in their pursual of sustainable agriculture, the UN has introduced the collaborative framework for food systems transformation (UN Environment, 2019). The framework consists of four actions: 1) food system champions identification; 2) food systems assessment; 3) multi-stakeholder dialogue and action facilitation; and, 4) strengthen institutional capacity for food systems governance (UN Environment, 2019). The last two actions are the focus of this thesis.

Several recent programmes of sustainable agriculture in developing countries have tried to implement the collaborative framework for food systems transformation (UN Environment, 2019). However, most current programmes, e.g. the programme of improving farmers nutrition in Kenya and financial support for SMEs in the agricultural

[1] https://sustainabledevelopment.un.org/sdgs (accessed on 7 May 2020)
[2] https://sustainabledevelopment.un.org/sdg2 (accessed on 7 May 2020)

1

sector in three African countries (Mozambique, Rwanda, and Kenya), followed a top-down approach with little participation by smallholder farmers and other actors in APSCs.

This top-down approach that is also widely used in the previous programmes of sustainable agriculture in developing countries, such as Good Agricultural Practices (GAP), Integrated Pest Management (IPM), Agroforestry, and Marine Protection, faces many challenges. Local actors are most often considered to be passive entities whom are encouraged to implement solutions designed by project initiators (e.g. governments, universities, NGOs). Most often, this approach results in the reluctance of smallholder farmers to implement the solutions provided, due to the fact that although they focus on improving the economic position of smallholder farmers (e.g. related to production, market, financial), they are often less compatible with factors related to local context (e.g. specific situations, local formal and informal institutions) (Espinoza-Tenorio *et al.*, 2015; Unnevehr, 2015).

Some programmes in developing countries, however, reported in (UN Environment, 2019) have followed a participation approach, such as sustainable food system policy-making in Senegal and the Zambian Food Change Lab. In these programmes, smallholder farmers are given space to identify their specific challenges and design solutions by themselves. These results are very promising, providing new insights on new forms of support required for sustainable development. However, these programmes focused on actors that are connected horizontally in the chain. Whereas, in food systems, actors are also connected vertically (e.g. linking local, national and international market players) in the chains in which power imbalance is inherent.

This thesis focuses on the participation of actors in the chains connected not only horizontally but also vertically. Participation of these actors is crucial to enable sustainable change in current practice in APSCs. However, as most actors of APSCs in developing countries are small actors who do not recognize the opportunity to change, empowerment is crucial to enable them to participate in pursuing sustainable APSCs.

Motivated by this situation, this thesis focuses on empowering agricultural chain actors (connected vertically and horizontally) to participate in pursual of sustainable APSCs.

This thesis focuses on multiple APSCs in Indonesia in which actors are connected vertically and horizontally as case studies for this thesis.

Agriculture is an important component of Indonesia's economy, in 2019, making up 13% of its GDP [3], and the largest source of employment [4]. However, like many other developing countries in Asia, e.g. Vietnam, Myanmar, Cambodia, Nepal, Bangladesh, India, Indonesia has a large number of smallholder farmers. In fact, 93% of farmers in Indonesia are smallholder farmers [5] whom cultivate land (on average) 0.6 Ha [6]. These smallholder farmers (with on average 5 to 6 household members) live in poverty with an

[3] www.bps.go.id/dynamictable/2015/05/06/828/-seri-2010-distribusi-pdb-triwulanan-atas-dasar-harga-berlaku-menurut-lapangan-usaha-persen-2014-2020.html (Accessed on 23 May 2020)

[4] www.bps.go.id/statictable/2009/04/16/970/penduduk-15-tahun-ke-atas-yang-bekerja-menurut-lapangan-pekerjaan-utama-1986—2019.html (Accessed on 23 May 2020).

[5] http://www.fao.org/3/i8881en/I8881EN.pdf (Accessed on 23 May 2020).

[6] http://www.fao.org/family-farming/data-sources/dataportrait/farm-size/en/ (Accessed on 23 May 2020)

average annual income of USD 1,967 despite other sources of income [7].

In APSCs, smallholder farmers in Indonesia very much depend on local traders (who connect farmers to markets) not only to market their products but also for funding for their farming activities. Most of their products are sold by local traders to traditional markets. Quality is often not the leading determinant for these markets.

As in many other developing countries, in Indonesia, many top-down programmes have been established to improve smallholder farmers' income and position in the chains by, e.g. government, universities, NGOs, donors. Most programmes have focused on improving product quality and facilitating smallholder farmers (in groups) to acquire access to markets directly (without local traders), in particular to modern markets (e.g. supermarkets, export markets) (Abdulsamad *et al.*, 2015; Maden *et al.*, 2014; van Der Laan *et al.*, 2016a,b). However, most programmes have had limited effect on the position of smallholder farmers (Abdulsamad *et al.*, 2015; van Der Laan *et al.*, 2016a,b). Lack of capacity of smallholder farmers to implement the initiatives (designed by programme initiators) and lack of coordination between them are the main reasons for this limited effect (Abdulsamad *et al.*, 2015; van Der Laan *et al.*, 2016a,b).

This thesis proposes a different approach to the design of a programme: empowerment of agricultural chain actors is the main goal from the start, providing a means for actors in APSCs to change their own position and situation together. The actors on which this thesis primarily focuses are smallholder farmers and local traders.

1.1. RESEARCH OBJECTIVE

This thesis has the objective to develop an approach to empower agricultural chain actors to pursue sustainable agricultural production and supply chains.

This objective is translated into the main research question: **"Can agricultural chain actors (connected vertically and horizontally) in Indonesia be empowered to pursue sustainable agricultural production and supply chains?"**.

The main research question is addressed in the following 4 sub-questions:

1. Which factors contribute to the participation of agricultural chain actors in pursuing sustainable agricultural production and supply chains in developing countries?
2. Considering these factors, can an approach to empower agricultural chain actors be designed?
3. Can the designed empowerment approach be implemented to improve vertical relations between agricultural chain actors in Indonesia? With which effects?
4. Can the designed empowerment approach be implemented to improve horizontal relations of agricultural chain actors in Indonesia? With which effects?

1.2. RESEARCH PHILOSOPHY, METHOD AND ETHICS

This research is Research through Design (RtD) combined with Action Research, more specifically, Participatory Action Research (PAR).

[7] http://www.fao.org/3/i8881en/I8881EN.pdf (Accessed on 23 May 2020)

1

Research through Design, firstly introduced by (Frayling, 1993), is a research approach that follows the designerly ways of thinking and acting to acquire a better understanding of complex situations (to develop knowledge) (Godin and Zahedi, 2014; Stappers and Giaccardi, 2017; Zimmerman *et al.*, 2007, 2010). RtD is characterised by the cycle of artefact creation (physical/non-physical), exploration of the use of an artefact with potential users, and reflection on this experience. The artefacts themselves play an essential role in knowledge development (Godin and Zahedi, 2014; Stappers and Giaccardi, 2017; Zimmerman *et al.*, 2007, 2010). First, artefacts are designed to fulfil requirements based on initial knowledge and situation analysis (Stappers and Giaccardi, 2017; Zimmerman *et al.*, 2007). Second, (verbal and non-verbal) communication between researchers and potential users during exploration of the use of these artefacts and reflections thereafter, increases understanding of the requirements and potential design space (Stappers and Giaccardi, 2017; Zimmerman *et al.*, 2007). The focus of RtD is on knowledge development through design (e.g. essential factors, framework, model for designing specific situations) (Godin and Zahedi, 2014; Stappers and Giaccardi, 2017; Zimmerman *et al.*, 2007, 2010).

Action research, firstly introduced by (Lewin, 1946), is a research approach that focuses on the implementation of solutions (based on situation analysis and initial knowledge) to not only enable changes in society but also develop knowledge through the cycle of planning, action, observation and reflection activities (Burns, 2005; Greenwood and Levin, 2006; Greenwood *et al.*, 1993; Kidd and Kral, 2005; Minkler, 2000; O'Brien, 1998). Participatory action research (PAR), is one of the forms of action research characterised by sharing power between researchers and participants in the decision-making process to determine solutions for changes (Greenwood *et al.*, 1993; Kidd and Kral, 2005; Minkler, 2000). Therefore, PAR leads to empowerment of participants (Baum *et al.*, 2006; Kidd and Kral, 2005; Minkler, 2000).

Based on the explanation above, there is a similarity between RtD and PAR (i.e. developing knowledge through continues action and reflection) (Stappers and Giaccardi, 2017). However, in RtD, an artefact(s) is an essential research element that does not always exist in PAR. The other difference is the action in PAR focuses on the changes in participants' situations, while RtD focuses on experiments to answer research questions that, do not necessarily directly affect participants.

In this research, the principles of RtD are followed to address the challenge of empowering agricultural chain actors (connected vertically and horizontally) to pursue sustainable APSCs through the design of an empowerment approach (a non-physical artefact). Meanwhile, the principles of PAR are followed to implement the designed approach with the agricultural chain actors, more specifically, with smallholder farmers and local traders. The reflection from the process and the effect of the approach implementation are performed to develop knowledge that can be useful to design further programmes of empowering agricultural chain actors to pursue sustainable APSCs.

With respect to the research paradigm, many characteristics of RtD and PAR overlap with the constructivism-interpretivism paradigm (Greenwood and Levin, 2006; Johannesson and Perjons, 2014; Ponterotto, 2005; Sanders, 2008; Stappers and Giaccardi, 2017; Tekin and Kotaman, 2013): 1) the multiple perspectives to interpret the reality are recognised; 2) reality is co-constructed through interactions between researchers and

participants; and, 3) there are intense interactions between researchers and research participants. However, in RtD and PAR, knowledge is developed through continuous action and reflection activities (Stappers and Giaccardi, 2017).

Research instruments used in this research are: 1) literature review to understand factors that should be taken into account in designing the empowerment approach; 2) semi-structured interviews to understand the local context of potential case studies; and, 3) case studies to implement the empowerment approach. Quantitative and qualitative methods are used to analyse the results.

With respect to research ethics, activities performed in this research have followed the research ethics that involve human as participants ruled by TU Delft Human Research Ethics (HRE). The committee of TU Delft HRE has approved the ethics of this research.

1.3. RESEARCH SCOPE

The APSCs on which this research focuses on are Indonesian horticultural supply chains, focussing on relations between actors who are connected, both vertically and horizontally. For the vertical relationships, this thesis focuses on the relationships between farmers and local traders. For the horizontal relationships, this thesis focuses on the relationships between farmers in a farmer organisation, more specifically in a group of farmer groups. The case studies are located in a horticultural production centre in Indonesia: the Bandung District, West Java (discussed in more detail in Chapter 5).

1.4. THESIS OUTLINE

This thesis consists of eight chapters. The outline of this thesis is provided in the Figure 1.1

Chapter 2 discusses three basic concepts that provide the foundation of this thesis: 1) agricultural production and supply chains in developing countries; 2) empowerment; and, 3) co-creation. This chapter also positions the research on which this thesis is based with respect to the literature and identifies the knowledge gap this thesis addresses, namely that a different empowerment approach (that focuses on improving actors' common understanding of situations, designing solutions by actors themselves, and implementing the solutions through working together) is needed to increase actors' participation in APSCs in developing countries to acquire sustainable development.

Chapter 3 addresses the first research question. This chapter proposes a framework for the analysis of sustainable agricultural production and supply chains in developing countries. Then, based on this framework, 49 programmes for sustainable APSC development reported in the literature, are analysed. This chapter shows that, in addition to environmental, economic and governance factors, social factors of empowerment and engagement are of importance for pursual of sustainable APSCs.

Chapter 4 addresses the second research question, proposing a novel approach to empowerment: the COCREATE approach. COCREATE is designed to empower agricultural chain actors (connected vertically and horizontally) to engage in pursuing common understanding of their situations, finding appropriate ways to deal with the situations and taking actions (through working together) to enable change.

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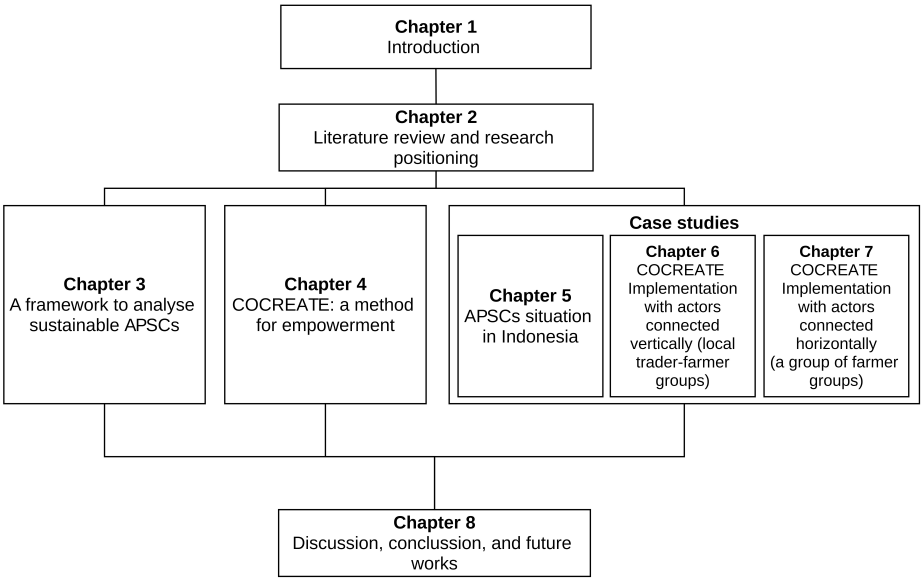

Figure 1.1: Outline of Thesis

Chapter 5 briefly describes agricultural practice in Indonesia distinguishing three types of APSCs. This chapter also presents the initial situation of the two cases studies performed in the context of this thesis involving local trader-farmer groups and a group of farmer groups.

Chapter 6 addresses the third research question. This chapter reports on the implementation of COCREATE implementation with agricultural chain actors connected vertically, more specifically with local trader-farmer groups. This chapter shows that COCREATE worked to empower farmers and local traders to improve their understanding on their own and others' situations, to find ways to deal with their situations and to work together to improve their situations. It resulted in a change in the relation between them with respect to production, market, and institutional aspects.

Chapter 7 addresses the fourth research question. It reports on the implementation of COCREATE with agricultural chain actors connected horizontally, more specifically with a group of farmer groups. This chapter shows that COCREATE also worked to empower farmers involved in a group of farmer groups to improve common understanding of their situation (as a group) and to self-organise their governance to deal with the encountered challenges. It resulted in the ability of the group of farmer groups to maintain the inclusion.

Chapter 8 synthesises the findings of this research. All stated research questions are answered, final conclusions provided, and future work proposed.

2

LITERATURE REVIEW AND RESEARCH POSITIONING

This thesis focuses on empowering agricultural chain actors in developing countries to pursue sustainable APSCs. Three basic concepts: 1) agricultural production and supply chain (especially in developing countries); 2) empowerment; and, 3) co-creation (an approach to empower actors) form the foundation of this research. This research is positioned at the intersection between these three basic concepts (figure 2.1).

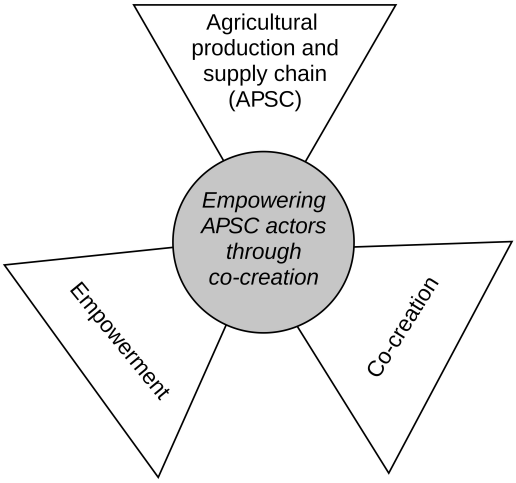

Figure 2.1: Research Positioning

This chapter provides a discussion of the basic concepts of this research (mentioned above). Section 2.1 discusses agricultural production and supply chains in developing countries. Section 2.2 discusses the concept of empowerment followed by the discus-

sion of the potential of a co-creation approach in Section 2.3. Section 2.4 presents the knowledge gap this thesis addresses.

2.1. AGRICULTURAL PRODUCTION AND SUPPLY CHAIN IN DEVELOPING COUNTRIES

APSC encompasses functions (decision making and physical) performed by actors to produce and to deliver agricultural products from farm to consumers (Van der Vorst *et al.*, 2007). Principal functions that connect actors in agricultural chains include production, market, logistics, finance (Van der Vorst *et al.*, 2007), and capacity development of ASPC actors to improve the functions in agricultural chains (Browning and Moayyad, 2017; Jouzi *et al.*, 2017; Valdez-Vazquez *et al.*, 2017). Institutions (formal and informal) govern the chain actors to enable them to perform their functions and the relationships between them (Van der Vorst *et al.*, 2007).

This thesis focuses in particular on ASPCs for fresh products, in particular on ASPCs for horticultural products.

The next section discusses the actors involved in these ASPCs and their functions in the APSC.

2.1.1. ACTORS AND THEIR FUNCTIONS IN THE APSCS IN DEVELOPING COUNTRIES

Many actors in the APSCs in developing countries are smallholder farmers whom have lack of access to assets, market, technology, and knowledge (Kariuki and Place, 2005; Sáenz-segura, 2006; Trienekens, 2011; van der Mheen-Sluijer and Cecchi, 2011).

Actors can be either Main Actors or Supporting Actors (Van der Vorst *et al.*, 2007), and the relationship between actors in the APSCs can be either vertical or horizontal (Trienekens, 2011). FIgure 2.2 illustrates an APSC system with actors and their functions in the chain for horticultural production and supply chains in Indonesia with these distinctions. This APSC, however, can be considered to be exemplary for APSC systems for fresh products in developing countries according to previous studies on APSCs in developing countries, e.g. (Van Hoi *et al.*, 2009) in Vietnam, (Subervie and Vagneron, 2013) in Madagascar, (Eaton *et al.*, 2007) in Uganda, Kenya and Tanzania, (Challies and Murray, 2011) in Chile.

The main actors connected vertically in Figure 2.2 from upstream to downstream are farmers, local traders, traditional market players, and modern market players (i.e. supermarkets, industries, export markets). There are also other market players such as, hotels, big restaurants and online shops.

With respect to the horizontal relation, farmer organisations facilitate collective actions by farmers including, most often, in relation to markets and production.

The actors and their functions are described below.

FARMERS

Activities performed by farmers are land and input preparation, planting crops, growth management, harvesting and selling of produce. Most farmers sell their produce to their local traders, possibly selling a small amount directly to local markets (very closed to

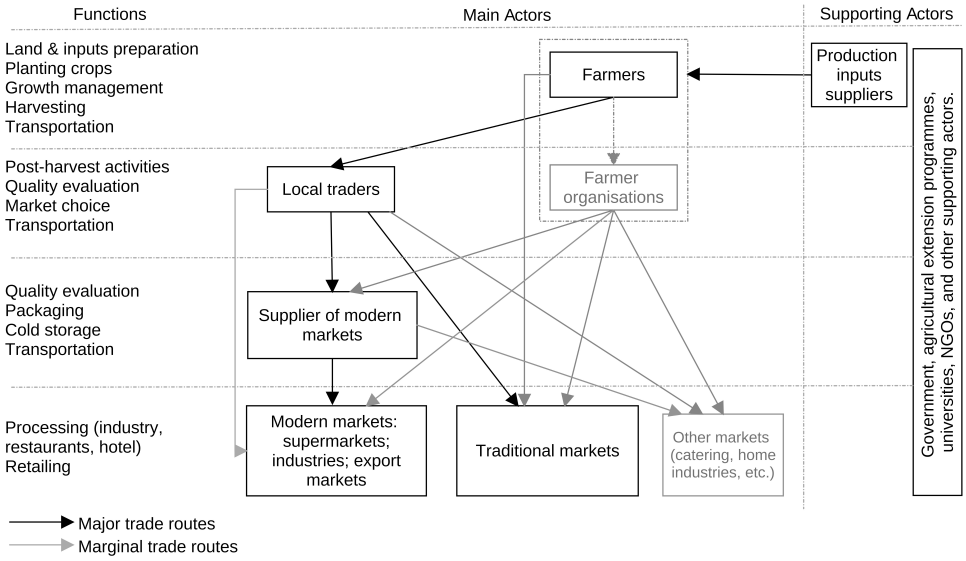

Figure 2.2: Horticultural Production and Supply Chain System in Indonesia (adapted from (Natawidjaja *et al.*, 2007a,b; Soviana and Puspa, 2012; Sunanto, 2013)

their location). Only a few farmers with a large amount of cultivated land sell to the traditional market directly (Natawidjaja *et al.*, 2007b,a).

LOCAL TRADERS

local traders perform post-harvest activities, i.e. cleaning, sorting, grading, and packaging before they sell produce to the markets (Natawidjaja *et al.*, 2007b,a). Most produce from local traders is sold to the traditional markets, and some of the produce with high quality is sold to the modern market players through the suppliers (Natawidjaja *et al.*, 2007b,a). However, not all local traders can sell their produce to modern market players because of the requirements (e.g. quality, supply schedule).

In the chain system, local traders are the centre of product flow (Sunanto, 2013). Most produce from farmers goes to them directly and local traders decide to which markets which produce will be sold, on the basis of quality control, i.e. sorting and grading (Natawidjaja *et al.*, 2007a; Sunanto, 2013).

In addition, local traders have a financial role, they provide credit for farmers, e.g. seeds, fertilizers and equipment. In other words, local traders have a role in the continuity of farmers' production activities (Natawidjaja *et al.*, 2007b,a).

FARMER ORGANISATIONS

In general, famer organisations in developing countries can be divided into: 1) informal farmer groups; 2) formal farmer groups; and 3) cooperatives (Kariuki and Place, 2005). Farmer organisations (FOs) facilitate collective selling of produce to markets, both modern markets (van Der Laan *et al.*, 2016a,b,c) and traditional markets.

FOs most often perform post-harvest activities before they sell produce to the markets (van Der Laan *et al.*, 2016b). FOs also have a financial: 1) facilitating access to financial support from external actors, e.g. the government, private parties; 2) managing internal credit system Markelova *et al.* (2009); van Der Laan *et al.* (2016a).

TRADITIONAL MARKETS

Traders in traditional markets buy produce from local traders, farmer organisations and farmers (mostly from local traders) and sell this produce to local customers and other retailers (small retailers) (Natawidjaja *et al.*, 2007b,a; Suryadarma *et al.*, 2010). Almost all of the produce from sellers (local traders, farmer organisations and farmers) is accepted by traders in the traditional market, because there are few requirements regarding the quality of produce. Traders in traditional markets usually only require sellers to separate the grade of produce into two grade: the big and small (Natawidjaja *et al.*, 2007a). One of the main risks in selling to traditional markets is the fluctuation of price (Natawidjaja *et al.*, 2007b,a).

MODERN MARKET PLAYERS

Modern market players including supermarkets, industries and exporters suppliers buy produce from local traders and farmer organisations, then sell it to their buyers (Natawidjaja *et al.*, 2007a; Sunanto, 2013). Only high-quality produce is of interest to modern market players, necessitating more extensive sorting and grading of produce by local traders and farmer organisations, and additional evaluation by modern market players themselves (Natawidjaja *et al.*, 2007a; Sunanto, 2013)..

SUPPORTING ACTORS

Supporting actors in the agricultural supply chain encompass the government, agricultural extension services, local universities, NGOs and supplier for production inputs. The government supports horticultural chain actors through their programs and policies (Zulkarnain *et al.*, 2012). Meanwhile, agricultural extension services, as a part of the government, provide technical assistance especially to farmers to improve their production activities (Natawidjaja *et al.*, 2007c,a). There are also some programmes from local universities, NGOs and other supporting actors. Most programmes consist of training and field assistances for farmers (Natawidjaja *et al.*, 2007a). The last-named supporting actors are suppliers of production input (e.g. seeds, pesticides suppliers). They not only provide production input for farmers, but also technical assistances especially in dealing with pests and plant diseases. However, the goal of their assistance is to encourage farmers to buy their (pesticide) products (Natawidjaja *et al.*, 2007b,a).

2.1.2. GOVERNANCE IN THE APSC

In this thesis, governance is defined as a set of rules and decision-making structures that govern involved actors in a social system (Reidsma *et al.*, 2011; van Zeijl Rozema *et al.*, 2008). Governance in the APSC encompasses formal and informal institutions.

Formal institutions are legalized by authorities to govern actors (e.g. laws, organisation regulations, written contracts) (Groenewegen and Van der Steen, 2006; Koppenjan and Groenewegen, 2005). Informal institutions are informal rules affecting the perception and behaviour of actors, and mechanisms for interaction (e.g. local cultures, norms,

verbal agreements) (Groenewegen and Van der Steen, 2006; Koppenjan and Groenewegen, 2005). This thesis embraces formal and informal institutions in APSCs.

Governance in the APSCs has the function to govern the transaction and relation between actors in the chain to reduce the risks (uncertainty, opportunisms) and to improve supply chain performance (cost, quality, delivery) (Trienekens, 2011; Zhang and Aramyan, 2009). The aspects APSC governance encompasses include product requirements, order and price mechanism, payment systems (Trienekens, 2011; Zhang and Aramyan, 2009).

Chain governance between actors connected vertically (e.g. between farmers and local traders) is formed through negotiation that is influenced by power imbalance (that exists in many agricultural production and supply chains in developing countries). Power imbalance between actors in these chains could result in unfair chain governance, that in turn could lead to the lack of commitment of actors. For example, in many cases in developing countries, the access of smallholder farmers to the market is controlled by local traders (through financial support) resulting in less fair price mechanisms (Natawidjaja *et al.*, 2014; Subervie and Vagneron, 2013).

Meanwhile, with respect to actors connected horizontally in FOs, governance includes sets of rules and decision-making structures to enable FOs to perform their roles in a sustainable manner (Beber *et al.*, 2018; Markelova *et al.*, 2009).

Chain governance between APSC actors, in particular in Indonesia, is discussed in more detail in Chapter 5.

2.1.3. APSC AS A COMPLEX SYSTEM

A complex system, in this research, is defined as a system consisting of multiple components that interact without central control in which the properties of emergence behaviour, non-linearity, feedback loops, and adapting and evolving exist (Cilliers and Spurrett, 1999; Corral-Quintana *et al.*, 2016; Gregoire and Catherine, 2007; Mitchell, 2006; Ottino, 2004; Sawyer and Sawyer, 2005). These properties are explained below:

1. Emergence occurs from the action of and interaction between components (as the responses to limited information) that resulted in collective behaviour that cannot be explained only from the behaviour of individual component (Cilliers and Spurrett, 1999; Ottino, 2004; Sawyer and Sawyer, 2005).

2. Non-linearity means that single action from any component could result in a significant effect on the whole system (Cilliers and Spurrett, 1999; Gregoire and Catherine, 2007; Sawyer and Sawyer, 2005).

3. Feedback loop means that effects of action from the individual component can affect the component itself Cilliers and Spurrett (1999).

4. Adapting and evolving. A complex system is an open system that interacts with the environment, so it affects and is affected by the environment. As the environment changes the system could adapt to the changes. Then, if the system can last for a long-time period, it can evolve Cilliers and Spurrett (1999); Gregoire and Catherine (2007).

APSC, based on its characteristics, is a complex system (Bryceson and Smith, 2008; Ge *et al.*, 2015; Higgins *et al.*, 2010; Ruiz-Garcia *et al.*, 2010; Surana *et al.*, 2005). It can be seen from the involvement of multiple interdependent actors (with various interests and goals) who form and interact through chain networks (Bryceson and Smith, 2008; Ge *et al.*, 2015; Higgins *et al.*, 2010; Ruiz-Garcia *et al.*, 2010; Surana *et al.*, 2005). Every actor, to some extent, has the autonomy to act independently (with partial information of the system) that contribute to the chain performance (Bryceson and Smith, 2008; Ge *et al.*, 2015; Surana *et al.*, 2005).

Properties of complex systems that are also exhibited in the APSC are the following:

1. Emergence. New relations can emerge in APSCs both in horizontal and vertical relations between actors (Surana *et al.*, 2005): in simple relations between actors in the more upstream tier, with other actors in the more downstream tier, and with other actors in the same tier, e.g. the relation between farmers-local traders-supermarkets, the relation among farmers (Surana *et al.*, 2005).

2. Non-linearity. A small event that effects an individual actor can have significant impact on chain performance (Ge *et al.*, 2015; Surana *et al.*, 2005). For example, in a farmer group, the failure of one farmer to fulfil the volume of produce (as it is agreed) can result in the failure of farmer group to fulfil market demand.

3. Feedback loop. Every action of every actor not only influences other actors but also influences (directly or not directly) the actor him/herself (Bryceson and Smith, 2008; Surana *et al.*, 2005). For example, if a farmer does not commit to an agreement with his/her farmer group, first this affects the farmer group, then it decreases the trust of the farmer group in the farmer.

4. Adapting and evolving. APSCs interact with their environment (e.g. markets, government) (Higgins *et al.*, 2010; Surana *et al.*, 2005). Therefore, APSCs should adapt (evolve in the long-time period) to changing circumstances (Surana *et al.*, 2005).

In pursuing sustainable APSCs, multiple aspects should be concerned, e.g. production, markets, environmental and social aspects (Higgins *et al.*, 2010). Coordination between actors (e.g. farmers, market players) is crucial (Corral-Quintana *et al.*, 2016; Surana *et al.*, 2005).

A complex systems approach helps to understand and improve APSCs. Previous studies have used simulation models (e.g. agent-based, discrete event, simulation-based optimisation) to understand and propose alternatives to improve APSCs, focusing on technical aspects e.g. minimising cost (Ge *et al.*, 2015), optimising sequential operation (Pavlou *et al.*, 2016), optimising inventory (Xu *et al.*, 2019). To embrace social and economic aspects, conceptual models have been used in previous studies on APSCs, e.g. system thinking models (Aragrande and Canali, 2020), correlation and risk models (Yindi and Hongjie, 2015), supply chain operational references (Reeveerakul and Lianghui, 2019), and integral theory (Hordijk and Jonkers, 2012).

These previous studies have helped to understand APSCs as complex systems and to design alternatives to improve them. However, APSCs as complex systems should also be understood by APSC actors themselves. It is important to improve their awareness of

the need for coordination between themselves. For this, empowerment of APSC actors is needed.

2.2. EMPOWERMENT

This section discusses the concept of empowerment used in this thesis. Examples of empowerment in APSCs in developing countries are also provided.

Empowerment can be seen from two perspectives, relational and motivational. From the relational perspective, empowerment is the process of sharing power between one actor and others, while from the motivational perspective, empowerment is the process of increasing the awareness of actors that they have the power to cope with a situation (Conger and Kanungo, 1988). In this thesis, both perspectives are of importance to empowerment.

Empowerment can be defined as that process that leads actors to perceiving themselves as capable of making and taking a role in decision making processes (Rowlands, 1995).

In this thesis, empowerment is defined as a process of improving actors' awareness of their own and others' situations (to pursue common understanding of situations), on their capability to take a role in decision making, to act and take responsibility, and to self-organise themselves to develop a participatory system (Brazier and Nevejan, 2014; Missimer *et al.*, 2017; Rowlands, 1995). Three levels of empowerment are recognised (Rowlands, 1995): development of a sense of self confidence and capacity of individual actors; development of the ability to negotiate to influence the nature of relationship; and development of a common understanding and collaboration among actors.

2.2.1. EMPOWERMENT IN APSC

Many programmes to empower agricultural chain actors in developing countries have been conducted by e.g. agricultural extension agents, governments, NGOs, universities. Three extensive programmes are identified: 1) training and visiting; 2) farmer to farmer training; and, 3) farmers field schools. These programmes are discussed below.

TRAINING AND VISITING

Training and visiting (T&V) is an approach developed by the World Bank in the mid 1970s (Benson and Jafry, 2013; Evenson and Mwabu, 2001; Rocha, 2017). This approach is still commonly used in developing countries to transfer knowledge from senders (e.g. agricultural extension agents, universities) to receivers (mostly farmers) (Baloch and Thapa, 2017; Benson and Jafry, 2013; Landini *et al.*, 2017; Singh *et al.*, 2016).

Lack of participation of farmers in applying knowledge taught by the external actors is one of the challenges this approach faces (Benson and Jafry, 2013; Evenson and Mwabu, 2001; Rocha, 2017). The external actors determine the knowledge to be transferred, design and conduct training and visiting activities, and monitor and evaluate the outcomes (Benson and Jafry, 2013; Evenson and Mwabu, 2001; Rocha, 2017). Local context is not always taken into account, making it often difficult for farmers to apply the knowledge acquired.

FARMERS TO FARMERS TRAINING

Farmer-to-Farmer programmes, also called Farmer-to-Farmer training (FFT) or Volunteer-Farmer-Trainer (VFTs), is an approach that involves trained farmers (as senders) to transfer knowledge to other farmers (as receivers) (Fisher *et al.*, 2018; Franzel *et al.*, 2018; Kawakami *et al.*, 2008; Kiptot and Franzel, 2015; Nakano *et al.*, 2018; Rocha, 2017). In this approach, selected farmers in a farming area are trained by agricultural extension officers or external parties to conduct field experiments (with support and packages of production input by agricultural extension officers). The trained farmers are then obliged to transfer the knowledge they obtained to other farmers in their area (Fisher *et al.*, 2018; Franzel *et al.*, 2018; Kiptot and Franzel, 2015).

Involving local farmers in transferring knowledge targets the challenge of including local context (Fisher *et al.*, 2018; Franzel *et al.*, 2018). However, often trained farmers lack the necessary technical skill needed, and motivation required (Fisher *et al.*, 2018; Kiptot and Franzel, 2015) to integrate this knowledge in the programmes they host.

FARMER FIELD SCHOOLS

Since the 1990s the Farmers Field School (FFS) approach has been developed by the Food and Agriculture Organization of the United Nations (FAO) explicitly to improve participation of local farmers to improve farming activities (Chhay *et al.*, 2017; Doocy *et al.*, 2017; Hussain *et al.*, 2017; Rocha, 2017; Settle *et al.*, 2014). In this approach, farmers are organised into groups consisting of about 25 persons per group. Each group is facilitated by one field agent who is usually an agricultural extension officer or by a farmer who has been trained in advance. These field agents train groups of farmers standard procedures of farming, and provide packages (good quality of seeds, and other production inputs) to conduct field experiments. Facilitated by the field agents, groups of farmers meet periodically in the field to analyse the condition of crops in every stage of growth (Anderson and Feder, 2007; Rocha, 2017; Settle and Garba, 2011a).

Despite some successful cases, this approach still faces major challenges in the sustainability of farmer participation (Rocha, 2017; Scheba, 2017). Lack of other chain actors' involvement (e.g. market actors) is believed to be one of main factors for farmers to discontinue their participation in the programmes (Scheba, 2017). In addition, even though this approach uses a participatory approach to some extent, the initiatives themselves (e.g. field experiments, production inputs) are organised by the field agents for the farmers, and knowledge transfer activities are most often still linear (from sender to receiver).

As can be seen, the programmes of empowering agricultural chain actors in developing countries focus on teaching on the production aspect following the linear learning process (from sender to receiver). Most often, these programmes follow a top-down approach with which solutions are designed by project initiators based on their own perspectives on situations faced by the local actors. There is little space for local actors to participate in analysing situations and designing solutions. It results in incompatibility of most solutions with factors related to the local context (Fisher *et al.*, 2018; Kiptot and Franzel, 2014). Therefore, local actors, most often, face difficulty to understand the solutions that lead to their reluctant to implement them. For this, a different approach of empowerment is required.

2.2.2. EMPOWERMENT INCREASING PARTICIPATION OF APSC ACTORS

Empowerment that explicitly addresses (the need for) coordination between actors whom are connected horizontally and vertically in agricultural production and supply chains is required to deal with the challenges of a top-down approach. Such coordination focuses on self-organisation.

In self-organisation, actors are connected based on mutual interdependency, they interact to build common understanding, participate in decision-making processes to create (emergent) institutions to govern their networks, and work together to achieve common goals (Andrews and Shah, 2003; Folke *et al.*, 2005; Gereffi *et al.*, 2005; Rhodes, 1996; van Zeijl Rozema *et al.*, 2008). Self-organisation is defined, in this research, as a dynamic and adaptive process that emerges from local interactions (without central control) (De Wolf and Holvoet, 2004; Serugendo *et al.*, 2006).

Participation of all relevant actors is vital to the success of self-organisation (Andrews and Shah, 2003). Participation is defined as "to be part of a specific larger whole, to be in a reciprocal relationship with a specific larger whole, for actors to have the ability to act and to take responsibility" (Brazier and Nevejan, 2014). It means that actors need to be aware that they are part of a network and have the ability to contribute and take responsibility for their actions. As most APSC actors in developing countries are small actors, empowerment is crucial to increase their participation.

A relatively large number of empowerment programmes have been implemented to increase participation of actors in sustainable APSCs. As mentioned above, the programmes of farmers to farmers training, aka "train the trainers" (Jors *et al.*, 2016; Kiptot and Franzel, 2014; Oumer *et al.*, 2014); and farmers field schools (Guo *et al.*, 2015; Islam *et al.*, 2011; Oumer *et al.*, 2014; Settle and Garba, 2011b), to some extent, have followed participatory approach. In these initiatives, however, agricultural chain actors often do not design solutions themselves, but are given the opportunity to learn of existing solutions, often without the option to connect this new knowledge to their own situation. Therefore, the solutions they learn, most often, do not fit with actors' characteristics and/or local context (Fisher *et al.*, 2018; Kiptot and Franzel, 2015).

Programmes that have included space for agricultural chain actors to contribute to the design of solutions to deal with their own specific situations have been carried out, both in developed countries (Bots and van Daalen, 2008; Murgue *et al.*, 2015) and in developing countries (Bene *et al.*, 2011; Bourgoin *et al.*, 2012; Macharia *et al.*, 2010), often focussed on acquiring involved actors' knowledge, perspectives, data and information as input to the design of solutions (by others), but not on letting them design the solutions themselves.

With respect to this, a different approach of empowerment to increase participation of APSC actors is needed. Considering ASPCs as complex systems, the approach should empower actors to improve their awareness of their chain situations through understanding each other situations and design alternatives (by themselves) to address the situations.

2.3. CO-CREATION

Co-creation can be used as an empowerment approach that supports participation of involved actors to self-organise (Bjogvinsson *et al.*, 2012; Rowlands, 1995; Spinuzzi, 2005).

Different definitions of co-creation have been proposed. (Prahalad and Ramaswamy, 2004; Galvagno and Dalli, 2014) define co-creation as a collaborative process of creating value by all involved actors. (Frow *et al.*, 2016) emphasize the engagement of actors in collaborative activities through interaction. (Durugbo and Pawar, 2014) define co-creation as a set of activities for fulfilling the needs of actors based on agreement and constraints that are defined by themselves. Meanwhile, (Sanders and Stappers, 2008) define co-creation as any act of creativity that is shared by two or more people.

In this thesis, co-creation is defined as a collaborative activity of actors to create an artefact (physical and non-physical) that is of use to the actors themselves. In this new perspective, actors are no longer treated as the passive entities whom just receive designs of products to be used, but they participate in design processes (Sanders and Stappers, 2008), in co-creation.

2.3.1. ACTORS PARTICIPATION IN CO-CREATION

In creating an artefact, at least three levels of participation are distinguished in the literature: 1) user-centred design; 2) co-design; 3) participatory design (Tang *et al.*, 2018). In user-centred design, designers design an artefact based on an understanding of needs and interests of users/actors (Tang *et al.*, 2018). In co-design, designers and users/actors work together to design an artefact, but the final decision on designs are the designers (Tang *et al.*, 2018). Meanwhile, in participatory design, users/actors are given autonomy to take control in every stage of artefact design (Tang *et al.*, 2018) including final decisions on solutions. For the co-creation approach this research proposes, participatory design is considered to be the most appropriate to engage actors in all stages of activities, and to empower them to create solutions they support.

In participatory design, co-creation occurs through intensive engagement and interaction of users/actors to create artefacts that are of use to themselves (Durugbo and Pawar, 2014; Edvardsson *et al.*, 2011; Frow *et al.*, 2016; Gronroos and Voima, 2013; Sanders and Stappers, 2008). Functional participation refers to increasing awareness of users/actors of their ability to contribute to the process (Bjogvinsson *et al.*, 2012; Rowlands, 1995; Spinuzzi, 2005).

2.3.2. LEARNING IN CO-CREATION

Through co-creation activities, involved actors, can learn from each other, change and expand their own and others' way of thinking (Numa *et al.*, 2008), or it is called learning through interactions (Armitage *et al.*, 2008; Landini *et al.*, 2017; Noguera-Méndez *et al.*, 2016). Learning through interaction can involve both linear processes of transferring knowledge from one actor (senders) to another (receivers), but also non-linear processes involving many interactions between actors, to acquire so-called social learning (Damsa and Ludvigsen, 2016; Henly-Shepard *et al.*, 2015; Landini *et al.*, 2017; Noguera-Méndez *et al.*, 2016; Pahl Wostl and Hare, 2004; Phuong *et al.*, 2018) .

Learning through interactions, however, requires an iterative process of sharing and reflecting on knowledge and experiences owned by actors through intensive discussions to reach common understanding (Axelsson *et al.*, 2013) to enable co-creation (Galvagno and Dalli, 2014; Yasui *et al.*, 2016).

2.3.3. CO-CREATION MEDIUM AND THE ROLE RESEARCHERS PROVIDE

In a co-creation process, an appropriate medium is needed (Yasui *et al.*, 2016). One of the types of media for co-creation processes is a workshop. A co-creation workshop facilitates actors to interact with each other, participate to share views and experiences, reach common understanding, and generate agreed solutions (Numa *et al.*, 2008; Yasui *et al.*, 2016).

In a co-creation process, researchers play a role as designers of a structure for workshops including sets of tasks, to be performed, the information system to be deployed and place of action. Designing the structure of a workshop is very important to create an environment of comfort and trust in order to enhance the willingness of the participant to share (Fraser and Harden, 2015). In addition, the structure of a workshop should provide the experience of autonomy for participants (Fuller *et al.*, 2011), that is the degree of actors' independence in selecting their own action in pursuing their agenda (Franklin and Graesser, 1996). In co-creation process, the autonomy of actors involved is gained when actors feel free and enjoy to express their ideas, to interact with others, and to get and give feedback to and from others (Fuller *et al.*, 2011).

2.3.4. THE USE OF CO-CREATION

Co-creation, in the last two decades, has been widely used as an approach for collaborative activity in multiple sectors. Many previous studies of co-creation have focused on the interaction between companies and their customers to co-create artefacts, e.g. (Bertoni *et al.*, 2014; Durugbo and Pawar, 2014; Payne *et al.*, 2008; Prahalad and Ramaswamy, 2004), from the perspective of service science, innovation and technology management, and marketing and consumer research (Galvagno and Dalli, 2014).

Co-creation has also been used in the healthcare sector to improve healthcare service ecosystem (Frow *et al.*, 2016; Lopes and Alves, 2020), and in the public sector to improve citizens' participation in policy design (Baptista *et al.*, 2020).

With respect to small actors with lack of education, skills and capital, implementation of co-creation would be more challenging (Dey *et al.*, 2016; Nahi, 2016). However, it has the potential to empower them to change (Dey *et al.*, 2016; Nahi, 2016). Previous studies of co-creation with small actors have focused on the interaction between companies and small actors as their consumers to co-create products or services that suitable for small actors (Dey *et al.*, 2016; Nahi, 2016).

With respect to APSCs, the study of co-creation in APSCs has still received little attention (Handayati *et al.*, 2015). Meanwhile, it is considered as a promising approach to improve coordination between APSC actors (Handayati *et al.*, 2015).

With respect to this, the potential of co-creation to empower APSCs actors, more specifically small actors, to design artefacts to enable change through improving coordination in their APSCs needs to be explored.

2.4. KNOWLEDGE GAP

APSCs are complex systems with multiple actors (e.g. farmers, local traders, modern and traditional market players) whom have the autonomy to take decision and actions based on their interests and goals. However, they are interdependent in their chain for which

coordination (through formal/informal governance) is essential.

With respect to pursuing sustainable APSCs, the participation of involved actors to self-organise has been recognised to be essential. Many previous programmes to empower APSCs actors in developing countries have followed the top-down approach. There is, however, a need for a different empowerment approach that increases actors' participation to pursue sustainable APSCs in developing countries.

In designing the new approach, identifying factors contributing to participation of agricultural chain actors in pursuing sustainable APSCs is required. For this, a comprehensive framework that can be used to analyse previous programmes of sustainable APSCs is needed.

Considering APSCs as complex systems, the approach for empowerment should be designed to improve understanding of actors of their chain situations through improving not only their own situations but also others' situations to pursue common understanding between them. Based on common understanding, the approach should facilitate actors to co-create alternatives (by themselves) to deal with their chain situations. Then, the approach should support actors to self-organise to implement co-created solutions.

With respect to this, there is a need for a study that: 1) identify factors contributing to the participation of involved actors to pursue sustainable APSCs in developing countries; 2) design an empowerment approach for APSCs actors in developing countries; 3) implement the approach with cases of APSCs in developing countries; and, 4) analyse the effect of the approach to the cases of APSCs.

3

PARTICIPATORY SUSTAINABLE AGRICULTURAL DEVELOPMENT: A FRAMEWORK TO ANALYSE PROGRAMMES OF SUSTAINABLE APSCs

Many programmes to pursue sustainable APSCs in developing countries have been conducted by, e.g. governments, NGOs, donors, even before the era of UN-SDGs. In fact, many studies to analyse these programmes have been performed and reported in the literature.

This chapter addresses the first research question: "Which factors contribute to the participation of agricultural chain actors to pursue sustainable APSCs in developing countries?". To this purpose, this chapter introduces a novel framework for sustainable APSCs that extends existing frameworks to include the potential for self-organisation to achieve equity of benefits: Participatory Sustainable Agricultural Development (PSAD). Then, this framework is used to position literature on sustainable agricultural development (SAD) programmes to identify strengths and weaknesses of these programmes with respect to the classes of factors distinguished in the framework for PSAD, and their effect over time.

Section 3.1 discusses frameworks of sustainable agriculture presented in the literature. Section 3.2 presents a novel framework for Participatory Sustainable Agricultural

This chapter is based on:
Kusnandar, F M Brazier, and O van Kooten. 2019. "Empowering Change for Sustainable Agriculture: The Need for Participation." *International Journal of Agricultural Sustainability*, 271–86. https://doi.org/10.1080/14735903.2019.1633899

Development (PSAD). Then, Section 3.3 explains the methodology deployed for the literature study to identify relevant SAD programmes in developing countries, followed by a section that focuses on the analysis of these programmes using the proposed PSAD framework (Section 3.4). The last two sections discuss the results of this study (Section 3.5) and the conclusions (Section 3.6).

3.1. PREVIOUS WORK ON THE FRAMEWORK OF SUSTAINABLE AGRICULTURE

Table 3.1 provides an overview of frameworks of sustainable agriculture presented in the literature, their foci, system in question, and factors considered.

Table 3.1 shows that most frameworks have been developed to measure sustainability, and to understand factors that will improve sustainability of agricultural production or agroecology systems. Most previous frameworks are characterised by quantitative measurement.

The object of analysis is sustainability of agricultural production or agroecology systems and have been analysed either only from the technical or social perspective.

As shown in Table 3.1 the Framework of Participatory Sustainable Agricultural Development (PSAD) this chapter proposes has been developed to analyse the sustainability of programmes of sustainable agricultural development (SAD) taking 4 perspectives into account: the environmental, economic, social and governance (discussed in more detail in Section 3.2).

3.2. FRAMEWORK OF PARTICIPATORY SUSTAINABLE AGRICULTURAL DEVELOPMENT (PSAD)

This section describes the proposed framework of PSAD. The framework consists of classes of factors and factors that contribute to sustainable agricultural development. The framework and its factors are discussed below.

Sustainable development, in this paper, is defined as a development that not only concerns current needs, but also a sustainable future for people and planet [1] (Brundtland, 1987). Often three classes of factors are associated with sustainable development: environmental, economic and social (Carter and Rogers, 2008; Demartini *et al.*, 2015; Harris, 2000; Munier, 2005), also known as planet, profit and people (Elkington, 2004).

These classes of factors are also identified in the agricultural sector (de Olde *et al.*, 2017; Dillon *et al.*, 2016; FAO, 2014; Grenz *et al.*, 2009; Komnitsas and Doula, 2017; Reidsma *et al.*, 2011; Speelman *et al.*, 2007; Van Cauwenbergh *et al.*, 2007; Zahm *et al.*, 2008). Environmental factors relate to the quality of production inputs and farming practices; Economic factors relate to productivity, profitability, stability and viability, while Social factors relate to local context, actor participation, and distribution of benefits (Demartini *et al.*, 2015; Dillon *et al.*, 2016; FAO, 2014; Grenz *et al.*, 2009; Harris, 2000; Komnitsas and Doula, 2017; Lehman *et al.*, 1993; Munanura *et al.*, 2016; Reidsma *et al.*, 2011; Speelman *et al.*, 2007; Van Cauwenbergh *et al.*, 2007; Zahm *et al.*, 2008).

[1] http://www.un.org/sustainabledevelopment/development-agenda/

Table 3.1: Frameworks of sustainable agriculture reported in the literature

Framework	Focus	Unit of analysis	Classes of factors
MESMIS (López-Ridaura *et al.*, 2002)	Understanding important factors to improve sustainability in natural resource management	Agroecology system	- Environmental - Economic - Social
SAFE (Van Cauwenbergh *et al.*, 2007)	Measuring sustainability in farm and agroecology systems	Production and Agroecology system	- Environmental - Economic - Social
IDEA (Zahm *et al.*, 2008)	Self-assessment for farmers to measure sustainability of their farm	Production system	- Environmental - Economic - Social
RISE Grenz *et al.* (2009)	Measuring technical aspects of sustainability in farm	Production system	- Environmental - Economic - Social
Sustainable Farming Dillon *et al.* (2016)	Measuring technical aspects of sustainable intensification in dairy sector	Production system	- Environmental - Economic - Social
Sustainable Agriculture in Small Island Komnitsas and Doula (2017)	Understanding important factors to improve the use and production of organic fertilizers	Agroecology system	- Environmental - Economic - Social
SAFA FAO (2014)	Measuring the impact of agricultural activities on sustainability	Production and supply chain systems	- Environmental - Economic - Social - Governance
PSAD (the proposed framework)	Understanding factors contributing to actors participation in sustainable development	Production and supply chain systems	- Environmental - Economic - Social - Governance

In addition to these three classes of factors, some literature also distinguishes governance related factors that address decision-making structures, institutions and regulations between multiple actors involved in SAD (FAO, 2014; Reidsma *et al.*, 2011; van Zeijl Rozema *et al.*, 2008).

Equity of benefits, the main mission of PSAD (Assembe-Mvondo *et al.*, 2013; Brown and Corbera, 2003; Gebara, 2013; McClanahan and Abunge, 2016; Munanura *et al.*, 2016) refers to factors such as equity of access to natural resources for present and future generations (environmental factor), equal access to resources, e.g. natural resources, finance, market resources (economic), inclusion of all actors in a chain (social) and decentralised decision making structures and processes that enable participation and institution development (governance-related) (Assembe-Mvondo *et al.*, 2013; Brown and Corbera, 2003; Gebara, 2013; McClanahan and Abunge, 2016; Munanura *et al.*, 2016).

3.2.1. CLASSES OF FACTORS AND FACTORS IN PSAD FRAMEWORK

PSAD encompasses classes of factors that have the potential to increase participation of APSC actors in SAD [2] with the mission to achieve equity of benefits. The classes of factors are: environmental, economic, social and governance.

Each class of factors, then, is translated to a set of factors that are believed to contribute to participation of APSC actors in SAD. These factors are associated with functions in the APSCs, e.g. planting, harvesting, post-harvest activities, transportation and market.The classes of factors and factors in the framework of PSAD are illustrated in Figure 3.1: the factors for which improvement is achieved.

Next sections discuss the class of factors and factors in the PSAD framework.

3.2.2. ENVIRONMENTAL

Environmental factors are associated with initiatives in the APSCs that contribute to maintaining natural resources (FAO, 2014; Van Cauwenbergh *et al.*, 2007; Zahm *et al.*, 2008). Three factors are distinguished: (1) water, land, and air (Demartini *et al.*, 2015; Dillon *et al.*, 2016; Grenz *et al.*, 2009; Harris, 2000), (2) biodiversity (FAO, 2014; Grenz *et al.*, 2009; Harris, 2000; López-Ridaura *et al.*, 2002; Van Cauwenbergh *et al.*, 2007), and (3) food safety (FAO, 2014; Grenz *et al.*, 2009; Van Cauwenbergh *et al.*, 2007). These three factors are described below.

1. *Water, land, and air*: factors related to protection of water, land, and air from any activities that can (directly or indirectly) cause damage (Demartini *et al.*, 2015; Dillon *et al.*, 2016; FAO, 2014; Grenz *et al.*, 2009; Komnitsas and Doula, 2017; Van Cauwenbergh *et al.*, 2007). Examples of activities that belong to this factor are water and land management, waste management, and reducing air pollutant and greenhouse gas emission in both on-farm and off-farm activities.

2. *Biodiversity*: factors related to protection of the extinction of important organisms (plant and animals) for ecosystems (FAO, 2014; Grenz *et al.*, 2009; López-Ridaura *et al.*, 2002; Van Cauwenbergh *et al.*, 2007), such as, for example, non-enemy essential anthropods (Pisa *et al.*, 2015).

[2] Experience gained from previous programme, for example, reported by the Peace Corps (Peace Corps, 2005)

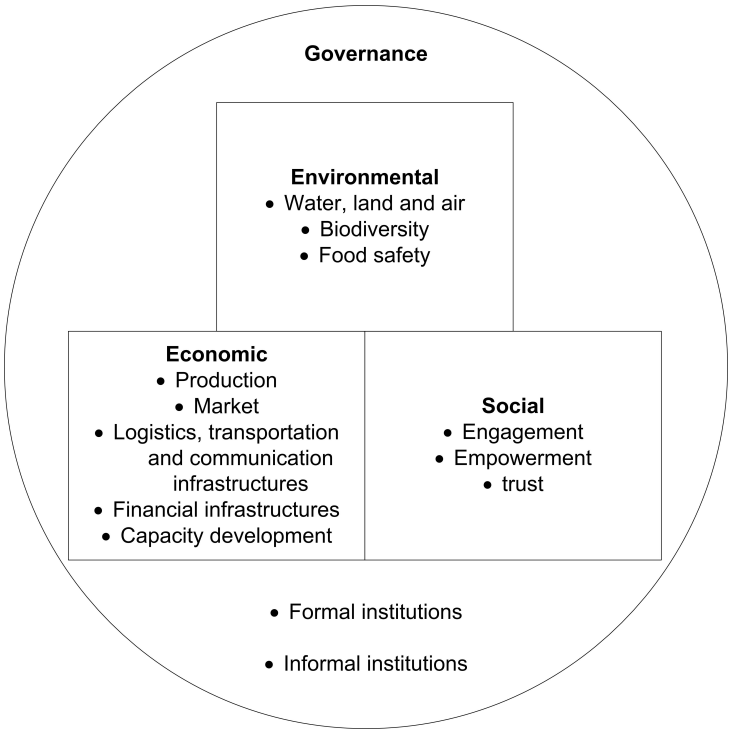

Figure 3.1: Framework of Participatory Sustainable Agricultural Development

3. *Food safety*: factors related to ensurance that all activities in the APSCs (on-farm and off-farm), from farm to consumers, avoid the risk of food-borne disease that can harm consumers (Alli, 2016; FAO, 2014; Jouzi *et al.*, 2017). Examples of food safety initiatives that focus on on-farm activities are Good Agricultural Practice (GAP), Integrated Pests Management (IPM), and Organic Farming. Meanwhile, examples of food safety initiatives that focus on on-farm and off-farm activities are Good Manufacturing Analysis (GMP), Sanitary and Phytosanitary Measures, and Hazard Analysis Critical Control Point (HACCP).

3.2.3. ECONOMIC

Economic factors are associated with functions that support the use of natural resources to produce agricultural products and to deliver it to consumers with the aim of both improving APSC actors prosperity and satisfy consumers in the long-term period (FAO, 2014; Van Cauwenbergh *et al.*, 2007; Zahm *et al.*, 2008). With respect to functions, the framework considers principal functions that connect actors along APSC systems: production, market, logistics, finance (Van der Vorst *et al.*, 2007). As this framework is implemented in developing countries, capacity development is recognised as one of the important economic factors (Browning and Moayyad, 2017; Jouzi *et al.*, 2017; Valdez-Vazquez *et al.*, 2017). These five factors of economic are described below.

1. *Production*: factors related to transforming or improving raw materials into desired products that encompass planning, implementation, control and coordination between chain actors to make it effective and efficient (Simchi-Levi *et al.*, 2005; Waters, 2003). In APSCs, production encompasses farming practices (including land preparation, planting and maintaining crops), harvesting, post-harvesting, and food processing.

2. *Market*: factors related to a network of interdependent actors who co-create value through resource exchange, e.g. material, finance, and information (Diaz Ruiz, 2012; Storbacka and Nenonen, 2011). As mentioned in Chapter 2, market for agricultural products encompasses traditional and modern (e.g. supermarkets, export) markets.

3. *Logistics, transportation and communication infrastructures*: factors related to the flow of material and information within an agricultural chain, within and between chain actors, such as efficiency and effectiveness (Farahani *et al.*, 2009; Simchi-Levi *et al.*, 2005; Waters, 2003).

4. *Financial infrastructures*: factors related to credit and cash flow to support material flow in the chain (Hofmann, 2005; Wuttke *et al.*, 2013). Financial infrastructures include the financing network between chain actors (e.g. cooperation between local traders and farmers, cooperative) and financing system supported by external actors (e.g. Government, NGOs).

5. *Capacity development*: factors related to performance of people, organizations, communities, including access to resources and opportunities, skills to improve social economic position (Bolger, 2000; Brinkerhoff and Morgan, 2010; Lusthaus *et al.*, 1999; UNDP, 1998). Examples of capacity development for APSC actors are class trainings and field technical assistances.

3.2.4. SOCIAL

With respect to social factors, the framework of PSAD focuses on the values of participatory systems discussed in (Brazier and Nevejan, 2014). Three values of participatory systems, that are essential to sustainable development (Brundtland, 1987; FAO, 2014; López-Ridaura *et al.*, 2002; Munier, 2005), are empowerment, engagement and trust (Brazier and Nevejan, 2014). These values correspond to the concept of the social aspects of sustainability proposed by (Missimer *et al.*, 2017): trust, common understanding, learning, and self-organisation.

Social factors of empowerment, engagement and trust are described below.

1. *Empowerment*: factors related to awareness of capability, decision making, ability to act and take responsibility, and ability to self-organise (Brazier and Nevejan, 2014; Missimer *et al.*, 2017; Rowlands, 1995).

2. *Engagement*: factors related to connectedness and interaction among actors to communicate, awareness of each others' positions, a common understanding, joint-decision making, working together and collective learning (Brazier and Nevejan, 2014; Missimer *et al.*, 2017).

3. *Trust*: factors related to quality of connection among actors in the system, in particular with respect to reliability Missimer *et al.* (2017). Trust develops over time (either in the positive or negative ways) as a result of actors' interactions (Bauer and Freitag, 2018; Rutter, 2001), either face to face or facilitated by ICT (Rutter, 2001; Sousa and Lamas, 2013).

As trust cannot be assessed short-term, and is difficult to measure in the context of specific programmes. Therefore, this study focuses on empowerment and engagement.

3.2.5. GOVERNANCE

Governance, in this framework, is positioned as an umbrella for the three classes of factors, as it is essential in any activities related to environmental, economic and social factors (FAO, 2014). Governance is defined as a collection of rules and structures on which institutions are based, formal and informal, that govern SAD (Reidsma *et al.*, 2011; van Zeijl Rozema *et al.*, 2008), involving actors for PSAD (Ostrom, 2010a).

1. *Formal Institutions*: factors related to formal rules that determine the legal positions of the actors and the mechanisms for interaction (Groenewegen and Van der Steen, 2006; Koppenjan and Groenewegen, 2005). These include international regulations and standards, national laws and regulations (Diaz-Sarachaga *et al.*, 2017; Harris, 2000; Missimer *et al.*, 2017; Munier, 2005).

2. *Informal institutions*: factors related to informal rules that determine positions of actors and mechanisms for interaction e.g. verbal agreements between actors (e.g. in selling produce, credit systems), local norms and culture (Groenewegen and Van der Steen, 2006; Koppenjan and Groenewegen, 2005).

3.3. METHOD

The PSAD framework proposed in the previous section has been used as the basis for a review of the focus and effects of SAD programmes reported in the literature.

The method entails (1) to determine the type of literature, database, time horizon and the context of these programmes, (2) to determine a list of keywords to search the literature, (3) to perform the literature search and to select appropriate literature on the basis of pre-defined criteria and (4) to analyse the selected literature using the proposed framework of SAD based on participation.

3.3.1. TYPE OF LITERATURE, DATABASE, TIME HORIZON AND CONTEXT

Only journal articles are considered, and Scopus is the database considered. As agricultural systems and their environment change continually, and the focus of this study is on the effects of programmes within their context, the time horizon of publication considered is limited to articles published in the last ten years, that is between 2008-2017. Developing countries are the context of the programmes chosen – a context for which empowerment is considered of great importance Angeles and Gurstein (2000).

3.3.2. KEYWORDS

The list of keywords is determined based on the desired topic, that is "efforts to pursue sustainable agriculture in developing countries". Four main concepts/keywords are considered: effort; sustainable development; agriculture; and developing countries. Synonyms or other terms or phrases that have the same meaning as one of the main keywords and/or are commonly used in scientific papers are determined by the authors. The keywords used to search the literature in this study are listed below.

EFFORT

- effort* OR intervention* OR program* OR initiative* OR scheme* OR action OR project* OR measure*

These keywords are commonly used to state efforts conducted by governments or organizations for efforts in the agriculture sector. The symbol * is used to accommodate plural and singular words, or US/UK spelling differences.

SUSTAINABLE

- sustainable OR sustainability.
- ((environment OR environmental) AND (conservation OR preservation OR protection)) OR "environmentally friendly".

Both sustainability and sustainable are both used to indicate the essence of sustainable, as is the concept of environmental conservation to pursue sustainability.

AGRICULTURE

- agriculture OR agricultural OR farming OR horticulture OR “grain crop*” OR “animal husbandry” OR livestock OR poultry OR dairy OR aquaculture OR fisher*.

These keywords define the scope of agriculture to include crops, animals and aquaculture.

DEVELOPING COUNTRIES

- “developing countr*” OR “less developed countr*” OR “underdeveloped countr*” OR “low income countr*” OR “low-income countr*” OR “lower middle income countr*” OR “lower-middle-income countr*”

These terms relate to the concept of a developing country. Some of them relate to level of income [3].

The search term based on the series of keywords defined above used to search the Scopus database for appropriate journal articles is:

(effort OR intervention* OR program* OR initiative* OR scheme* OR action OR project* OR measure*) AND (sustainable OR sustainability OR ((environment OR environmental) AND (conservation OR preservation OR protection)) OR "environmentally friendly") AND (agriculture OR agricultural OR farming OR horticulture OR “grain crop*” OR “animal*

[3] https://blogs.worldbank.org/opendata/new-country-classifications-income-level-2017-2018

husbandry" OR livestock OR poultry OR dairy OR aquaculture OR fisher) AND ("developing countr*" OR "less developed countr*" OR "underdeveloped countr*" OR "low income countr*" OR "low-income countr*" OR "lower middle income countr*" OR "lower-middle-income countr*").*

3.3.3. SELECTION

The criteria on the basis of which journal articles are selected in the analysis are: (1) contains a description of at least one programme on sustainable agriculture development in developing country(ies); and (2) describes the approach used in the programme(s).

Selection of papers followed a two-step procedure: First, the abstract of the papers are assessed with the given criteria. Second, the papers for which the abstract is judged to meet these criteria are analysed in depth to determine if, in fact, they meet the criteria.

3.3.4. PROCEDURE FOR ANALYSIS

Each of the selected papers are analysed using the PSAD framework. The analysis of the SAD programme to which they refer is based on the factors in the proposed framework. An ordinal value is assigned to each factor for each paper/programme: a value of "2" if the factor is named and considered, a value of "1" if the factor is considered to a limited (implied) extent; and a value of "0" if the factor is not considered.

The effect of programmes is determined on the basis of information provided in the papers considered. An ordinal value is assigned to each programme: a value of "2" if long-term effects are reported, a value of "1" if short-term effects are named, a value of "0" if little or limited effect is indicated, and a value of "NA" if no information on effects is mentioned. Programmes that have lasted for 4 years or more, with a positive effect are classified as having a long-term effect. Continuity of actor participation in SAD is the determining criterium. Short-term effect is assigned to programmes with a reported positive effect that have run for about 1-3 years, with no further information about the sustainability of participation of involved actors. Limited effect is assigned to programmes that have stated to have had little effect or limited effect. Programmes without any information about their effect are classified as unknown.

The Spearman test [4] is used to determine possible correlations between the factors in the proposed framework and the effect of programme.

3.4. RESULTS

This section provides the results of: 1) the literature search and selection; 2) the analysis of the focus of programmes based on the factors in the framework of PSAD; 3) the analysis of the effect of programmes; and, 4) the correlation between factors in the framework of PSAD and the effect of programmes.

The selection process using the set of keyword combinations and Scopus as a database resulted in 491 papers. 76 papers were selected on the basis of their abstracts and the criteria of naming at least one programme and describing the approach taken. Based on deeper analysis of the papers themselves, 45 papers were found to meet the criteria.

[4] Spearman test is one of techniques that is used to test correlation for non-parametric data (Corder and Foreman, 2009)

From the selected papers, 1 paper refers to 3 programmes, and 2 papers each report on 2 programmes: 49 programmes were identified in total. For one programme, additional information was acquired from another paper (to which the paper referred).

The programmes were analysed using the factors distinguished within the PSAD framework. The matrix of programmes and the factors in the PSAD framework is depicted in Appendix 1. Table 3.2 shows the number of programmes that consider each of the factors in the PSAD framework.

Table 3.2: Number of cases of programmes considering the indicators of the framework of sustainable development

Element	Indicator	Number of cases considering the indicator	% of total cases
Environmental	Soil, water, air	36	73%
	Biodiversity	18	37%
	Food safety	5	10%
Economic	Production	25	51%
	Market	6	12%
	LTCI*	2	4%
	Financial inf.	11	22%
	Capacity dev.	31	63%
Social	Engagement	10	20%
	Empowerment	13	27%
Governance	Formal inst.	27	55%
	Informal inst.	9	18%

*) Logistics, transportation and communication infrastructures

Table 3.2 shows that most programmes focus on environmental, economic and governance-related factors. More specifically on protecting soil, water and air (environmental), capacity development and production (economic), and formal institutions (governance-related). Most programmes follow the top-down approach that focussed on capacity development, formal institutions and production with relatively high number of cases to encourage farmers to participate in environmental protection. Class training and field technical assistance were methods often used for capacity development to disseminate knowledge, and to develop knowledge and skills of farmers for sustainable farming practice. These capacity development programmes were often integrated with production inputs provisions (production-related). Meanwhile, for formal institutions, mandatory and voluntary regulation with and without incentives were applied in many programmes. Most formal institutions were designed by the government and international organisations, and some were based on agreements/contracts between farmers and companies using various schemes.

With respect to the effect of programmes (Appendix 1), most programmes (21 programmes) have limited effect, 12 programmes have short-term effect, and 8 programmes have long-term effect. The effect of 8 programmes is unknown.

For programmes with limited effect, four causes were named explicitly. First, conflict of interest between involved actors was named for cases 6, 15, 22, 30, 31 and 43. Some of these programmes, for example, focus on protecting areas from environmental

damage caused by farmers' activities or to develop new products that can contribute to environmental protection. However, the programmes have a negative impact on local farmers' livelihoods leading to conflicts between local farmers and programme implementers. Limited effect was the result. Second, a mismatch between technology offered in the programmes and the local situations, farmers' characteristics and farming behaviour, and local market chains structure and governance (cases 1, 2, 3, 4, 11, 19, 28, 37, 35), was explicitly named as a cause for limited effect. Third, the absence of support to translate theoretical information into actionable information/practice for local farmers (cases 12, 13, 19) was named as a cause for limited effect. In these cases, short training was provided to disseminate specific knowledge on (farming and waste management) technology. Fourth, lack of transparency of the structure and rules of new institutions was named as a cause for limited effect (cases 25, 26). In these programmes, the new institutions were designed by only a few actors or by the government. Other actors were not involved and were not provided with enough information to understand (the implications of) the new institutions.

3.4.1. CORRELATION BETWEEN FACTORS IN PROPOSED FRAMEWORK AND THE EFFECT OF PROGRAMME

Table 3.3 depicts the results of the Spearman test indicating correlations between each factor in the PSAD framework and the effect of each of the programmes. The strength of correlation is interpreted in line with (Corder and Foreman, 2009) as: 0 for trivial; 0.1 for weak; 0.3 for significant; 0.5 for strong; and 1.0 for perfect. In this analysis, the programmes with unknown effect have been excluded.

Table 3.3: Correlation between factors in the proposed framework and the effect of programmes using Spearman test.

Factors	Spearman coef.	Prob
Environment		
Water, land and air	-0.12	0.474
Biodiversity	-0.15	0.359
Food safety	0.36	0.021*
Economic		
Production	0.36	0.021*
Market	0.26	0.099
Logistics, transportation and comm. Inf.	-0.03	0.87
Finance infrastructure	0.03	0.831
Capacity development	0.31	0.049*
Social		
Empowerment	0.38	0.015*
Engagement	0.45	0.003*
Governance		
Formal institutions	-0.15	0.351
Informal institutions	0.21	0.184

*) significant at α = 5%

Table 3.3 shows that food safety is the only factor within the environmental class of factors that has a significant correlation with the effect of programme.

Production and capacity development are factors within the economic class of factors that have a significant correlation with the effect of programme.

Both factors analysed within the class of social factors: empowerment and engagement, show a significant correlation with the effect of programmes. In fact, the coefficient of these two factors are the two highest (0.38 and 0.45 respectively).

3.5. DISCUSSION

This section, first, provides the discussion of the focus and the effect of programmes. Then, it is followed by the discussion of factors in the framework of PSAD that are significantly correlated with the effect of programmes.

3.5.1. THE FOCUS AND THE EFFECT OF PROGRAMMES

Most programmes on pursuing sustainable APSCs in developing countries follow a top-down approach in governance focusing on economic and environmental factors to encourage farmers to participate. Meanwhile, little attention is given to the social dimension. This result corresponds to previous findings on sustainable development (Dempsey *et al.*, 2011; Missimer *et al.*, 2017), whilst its importance has been recognized, in particular as centralised governance is often not feasible (Folke *et al.*, 2005).

This paper shows that most top-down programmes have little or limited effect on sustainable APSCs. The challenges identified in this study with respect to effect over time are in line with previous studies: conflicts of interests between involved actors (Wang and Chen, 2014), incompatibility of technology with local situations (Buch-Hansen, 2012; Espinoza-Tenorio *et al.*, 2015; Unnevehr, 2015), the need for support to translate theoretical knowledge into practice (Reidsma *et al.*, 2011), and the lack of transparency of new institutions (Douxchamps *et al.*, 2015).

The social complexity of multiple actors in different roles in the agricultural production and supply chain (van Zeijl Rozema *et al.*, 2008) mandates a different approach for SAD. In the programmes that targeted engagement participants were provided opportunities to interact and communicate with each other to improve understanding of each other's situation and needs (Brazier and Nevejan, 2014; Missimer *et al.*, 2017), increasing awareness and ability to create new forms of coordination, in which actors can act and to take responsibility within their group or communities, and within the chain (Missimer *et al.*, 2017; Rezaee *et al.*, 2015; Rowlands, 1995).

3.5.2. FACTORS SIGNIFICANTLY CORRELATED WITH THE EFFECT OF PROGRAMMES

The significant correlations for the environmental (food safety), economic (production and capacity building) and social aspects (empowerment and engagement) named above with the effect of programmes are discussed below.

The environmental factor of food safety, included in food safety standards, such as Good Agricultural Practices and Integrated Pests Management, implemented in programmes as a tool for farmers to acquire access to global markets (Cases 26 and 41) have

shown to be successful in targeting long term effects. Access to global markets that offer a better price, encourage farmers in developing countries to follow food safety standard in their farming activities (Unnevehr, 2015).

Economic factors related to production: production inputs, production facilities (e.g. tools, machine), and knowledge of technical aspects of production, are explicitly addressed in programmes designed to improve production over time (e.g. cases 17, 26, 29, 39, 40), and have shown to be successful in their effect. Capacity development, the second economic factor with a significant correlation with effect, has shown to be effective for instructor-led training, field assistance (by project implementers) and peer to peer assistances methods aimed to improve knowledge and skills of farmers to pursue SAD (e.g. cases 16, 17, 26, 29, 39, 41). As most farmers in developing countries still have lack of knowledge and skills to improve their farming (Gereffi and Fernandez-Stark, 2016) activities to enhance their capacity, especially in technical aspects of production, are clearly still important.

The social factors of engagement and empowerment have shown to be effective over time: first, in programmes that focus on increasing awareness of local farmers through discussion to analyse their situation, and to find solutions most often facilitated by project implementers (cases 16 and 49); and second, in programmes that provide local farmers opportunities to act and take responsibility for their own actions (cases 16 and 41).

Three types of engagement for which a positive correlation with long-term effect was identified are: (1) engagement facilitated by project officers or other parties, in which local farmers were directly involved in programme activities, for example in discussions on their own situations and on assessments of their own resources (cases 16, and 40); (2) engagement of local farmers, who were trained first, involved in information and knowledge dissemination to other farmers (cases 29 and 41); and (3) engagement of local farmers who were organized into groups or institutions to work together to foster sustainable practice, with/ without a facilitator (cases 17 and 29).

Independent of the type of engagement, continued facilitation in a follow-up programme, has shown to correlate with a long-term effect (cases 16, 17, 29, 40, 41). The follow-up implemented in one of the programmes (case 29), enabled a gradual shift of roles from project implementer to local farmers, over time. This result is in line with the claim that continued facilitation is needed to foster self-organisation (Folke *et al.*, 2005) to maintain the momentum of change for local farmers.

3.6. CONCLUSION

This chapter proposes a novel framework of PSAD based on four classes of factors that influence actor participation in sustainable APSCs: environmental, economic, social and governance-related. The proposed framework has been developed to analyse sustainable agriculture programmes in developing countries, to understand factors that influence participation of actors.

Five factors in the PSAD framework have shown to have long-term effect on sustainable agriculture programmes: food safety (environmental), production, capacity development (both economic), empowerment and engagement (both social).

Based on these findings, in designing an approach to support participation of agricultural chain actors to pursue sustainable APSCs, the social factors of engagement and

empowerment should be the focus of the approach, in addition to economic and environmental factors. Moreover, the designed approach should take into account the importance of follow-up programmes.

4

COCREATE: AN APPROACH TO EMPOWER LOCAL ACTORS TO ENGAGE IN SUSTAINABLE APSCs DEVELOPMENT IN DEVELOPING COUNTRIES

Chapter 3 shows that in addition to economic and environmental factors, social factors of engagement and empowerment are of importance for the participation of chain actors in pursuing sustainable APSCs. Co-creation (discussed in Chapter 2) facilitates engagement and empowerment, and as such is the approach this thesis explores. A specific approach is proposed in this chapter, addressing the second research question: "Can an approach to empower agricultural chain actors be designed?".

The COCREATE approach has been designed and evaluated to this purpose, to empower chain actors to collaborate to increase their shared understanding of their own situations, to devise and implement potential sustainable solutions.

Section 4.1 compares previous approaches for sustainable APSCs discussed in Chapter 3 with respect to empowerment and relates these to the goals of the COCREATE approach this chapter proposes. Section 4.2 motivates the design perspective on which

This chapter is based on:

1. Kusnandar, K., van Kooten, O., & Brazier, F. M. (2019). Empowering through reflection: Participatory design of change in agricultural chains in indonesia by local stakeholders. *Cogent Food & Agriculture*, 5(1), 1608685. https://doi.org/10.1080/23311932.2019.1608685
2. Kusnandar, K., van Kooten, O., & Brazier, F. M. (2020). COCREATE: A Self-directed Learning Approach to Agricultural Extension Programmes. *Accepted in Development in Practice (November 2020)*

COCREATE is based. Section 4.3 discusses the types of empowerment for which COCREATE has been designed. Section 4.4 presents the COCREATE approach. Section 4.5 provides the conclusion of this chapter.

4.1. PREVIOUS APPROACHES TO PURSUING SUSTAINABLE APSCS AND THE COMPARISON WITH COCREATE

The literature reviewed in Chapter 3 shows that 2 different approaches have been deployed in the pursual of sustainable APSCs: 1) top-down; and 2) participatory, and that their focus differs. Table 4.1 analyses the previous approaches with respect to these aspects and compares them to the COCREATE approach this chapter proposes.

Table 4.1: Previous approaches to pursuing sustainable APSCs in relation to the goals of COCREATE

	Previous Approaches		COCREATE
	Top-down	Participatory	
Understanding situations	Little space for local actors to understand their own situations	Space for local actors to understand their situations	Local actors are supported to understand their own and others situations to pursue a common understanding of the chain
Designing solutions	All solutions come from the project initiators	Space for local actors to contribute to designing solutions	Solutions come from the local actors
Involved actors	Mostly farmers (horizontal relation)	Mostly farmers (horizontal relation)	Farmers and other actors in the chain (vertical & horizontal relation)

Previous approaches to pursuing sustainable APSCs are characterised by the significant roles of project initiators in identifying a situation with a need for change and designing solutions. In top-down approaches, project initiators identify the local actors involved, and, then design solutions (based on their perceptions) to be implemented by the local actors. In (previous) participatory approaches, even though there was space for local actors to better understand their positions, and the need for change, and to be involved in the design of solutions, most solutions were still determined by the project initiators in the end based on input from local actors (e.g. programmes of farmer field school and farmer-to-farmer trainings).

COCREATE is an approach for empowerment in which local context is the basis for change. In this approach, solutions are designed and developed by local actors themselves (Ostrom, 2010b,a). For this, pursuing a common understanding of involved actors is essential. The basic assumption behind this approach is that local actors have the capability to learn and to govern themselves to deal with their situations (Ostrom, 2010b,a).

With respect to actors involved, the approaches presented in Chapter 3, in most cases, only consisted of farmers (connected horizontally), and focused on the challenges they encountered (e.g. in production, market, finance). COCREATE involves multiple ac-

tors in the chains who are not only connected horizontally, but also connected vertically for which power relations are involved. Therefore, the focus of COCREATE is to empower agricultural chain actors to engage in developing a means to also improve chain coordination.

As reported in 3, the implementation of solutions in the approaches described faced challenges, e.g. incompatibility of designed solutions with local situations, conflict of interests between involved actors. The participatory approaches identified showed promising results. However, they only focused on farmers' perspectives. Meanwhile, to pursue sustainable APSCs, the involvement of different actors in the chain, and the pursual of common understanding between these actors are essential.

In this thesis, the focus of COCREATE is on the relations between farmers and market players, especially local traders (vertical relation), and the relations between farmers in farmer groups (horizontal relation) (discussed in more detail in Chapter 5).

4.2. DESIGN PROCESS

The co-creation process to empower actors in the agricultural chains is a design process for which different activities are of importance, described briefly in this section.

A design process is a sequence of steps in creating an artefact (Howard *et al.*, 2008; Tayal, 2013; van Boeijen *et al.*, 2014) that can be physical or non-physical (MacLean *et al.*, 1991; Tayal, 2013). The steps are not linear, and each step involves decisions on requirements, solutions, and the process itself (Brazier *et al.*, 1996; Howard *et al.*, 2008; Tayal, 2013; van Boeijen *et al.*, 2014).

These three subtasks in the design process are distinguished in the Generic Model of Design introduced by (Brazier *et al.*, 1997; van Langen and Brazier, 2006) : 1) requirement design; 2) design object design; and 3) design process coordination. Requirements design identifies requirements based on needs and desires of involved actors (including information such as should have, could have, and will not have, reasoning about their prioritization for consideration in design object design). Design object design generates possible solutions to satisfy these requirements based on e.g. function, structure, process plan, etc. Meanwhile, design process coordination determines whether the progress in a design process can be accepted and can be continued, backtracked, modified, or should be terminated based on the result of design object and requirements. A design can be changed due to the set of requirements, also the set of requirements can be modified due to the constraints in design options to fulfil requirements. Note there is continues interaction between the subtasks requirements and design object coordinated by the subtask of coordination.

For the COCREATE approach this thesis proposes, the above implies the need to distinguish discussion about requirements for solutions from discussion about the solutions themselves, and to separately consider the rules of game – coordination of the co-creation process.

4.3. EMPOWERMENT IN COCREATE

The type of empowerment on which COCREATE focus is to improve agricultural chain actors' awareness of their capability for change by working together to co-create (Sanders

and Stappers, 2008) solutions to existing challenges that are appropriate for their own situations. This requires that agricultural chain actors not only have knowledge about their own situation, but also about each other's situations to acquire common understanding, to be able to reflect on each other's position (Andersen, 1987).

More specifically, COCREATE is designed to: 1) facilitate actors to learn from their own experience and others' experience/perspectives to improve common understanding of their chain situations; 2) facilitate actors to find appropriate ways (by themselves) to deal with their situations; and 3) support actors to take actions (through working together) to enable changes in their APSCs. This process enables involved actors not only to learn from but also to influence other perspectives.

With respect to the learning process, the involvement of multiple actors in the chains (e.g. farmers and local traders) enables COCREATE to embrace knowledge in multiple aspects of production and supply chain. APSC encompasses not only about production (that many previous programmes focus on) but also mandates an understanding of the market chain, and how chain governance works, including knowledge of how market and financial institutions function (Trienekens, 2011). In fact, in developing countries, most farmers are very dependent on local traders and their knowledge of finance, land and markets (Natawidjaja *et al.*, 2014; Subervie and Vagneron, 2013).

With respect to this, knowledge from external actors is still needed in COCREATE. Therefore, COCREATE facilitates the involvement of external actors, e.g. agricultural extension agents, universities, the government, to support the involved actors.

4.4. REFLECTION THROUGH PARAPHRASING TO SUPPORT EMPOWERMENT IN COCREATE

Core to empowerment process of actors in COCREATE is understanding each other's perspectives (Clement and Van den Besselaar, 1993; Kpamma *et al.*, 2017; Martins *et al.*, 2018; Ostergaard *et al.*, 2018). Understanding, in turn, requires reflection. Reflection is defined, in this paper, as a process of considering others' perspectives, then comparing and assimilating them into their own perspective (Andersen, 1987; Davis, 2003; Frith and Frith, 2012). This process of reflection not only enriches each actor's own perspectives, but increases the level of common understanding between actors (Andersen, 1987; Davis, 2003; Frith and Frith, 2012) .

Many techniques can be applied to increase reflection, one of the simplest is paraphrasing. Paraphrasing entails explicitly re-phrasing an expression whilst keeping the same meaning (Bhagat and Ravichandran, 2008; Recasens and Vila, 2010).

4.5. COCREATE APPROACH

Based on the tasks involved in design process, type of empowerment, and reflection through paraphrasing discussed above, the following design for COCREATE has been designed. The detailed procedure of COCREATE is explained below.

COCREATE consists of two activities: 1) design activities; and, 2) implementation activities. In COCREATE, there is no fixed divide between design activities and implementation activities – the approach is cyclic with continuous feedback between the two

types of activities, both in co-creation (Figure 4.1) [1].

4.5.1. DESIGN ACTIVITIES

Two phases are distinguished in the design activities: Phase A and Phase B. In Phase A, participants (agricultural chain actors) work together to understand their current situations, and then identify possible solutions to deal with these situations. Meanwhile, in Phase B, participants work together to determine agreed solutions, action plans and the division of roles and responsibilities.

PHASE A

Three stages are distinguished in Phase A:

1. Identifying strengths and weaknesses.

   In this stage, participants identify strengths and weaknesses of their current situations, writing them on post-it notes, collected on a flipchart. Together they then group similar strengths and weaknesses on the flipchart to acquire a list of aggregated "unique" strengths and weaknesses.

2. Identifying challenges.

   Based on these strengths and weaknesses participants identify main challenges they face. A challenge is defined as something that needs to be solved to achieve a desired situation. These challenges are also written on flipchart papers as input for the next stage.

3. Generating possible solutions.

   In this stage, participants work in groups to generate possible solutions to deal with the challenges identified. They write possible solutions on post-it notes and place them on the flipchart – one post-it note for each identified solution. They then group similar solutions on the flipchart to acquire a list of aggregated "unique" possible solutions. These possible solutions are also written on flipchart papers as input for the next stage.

PHASE B

Four stages are distinguished in Phase B:

1. Choosing challenges and solutions to discuss.

   Based on the results of Phase A, participants choose the challenges and solutions that they think are most important. They then together determine which challenges and solutions are to be discussed first.

2. Exploring challenges and solutions.

   In this second stage, participants, in groups, discuss the chosen challenges and solutions. They each, in turn, indicate what the challenges mean for them individually,

[1] Presented in Kusnandar, K., van Kooten, O., Brazier, F. M. (2020). *Accepted in Development in Practice (November 2020)*

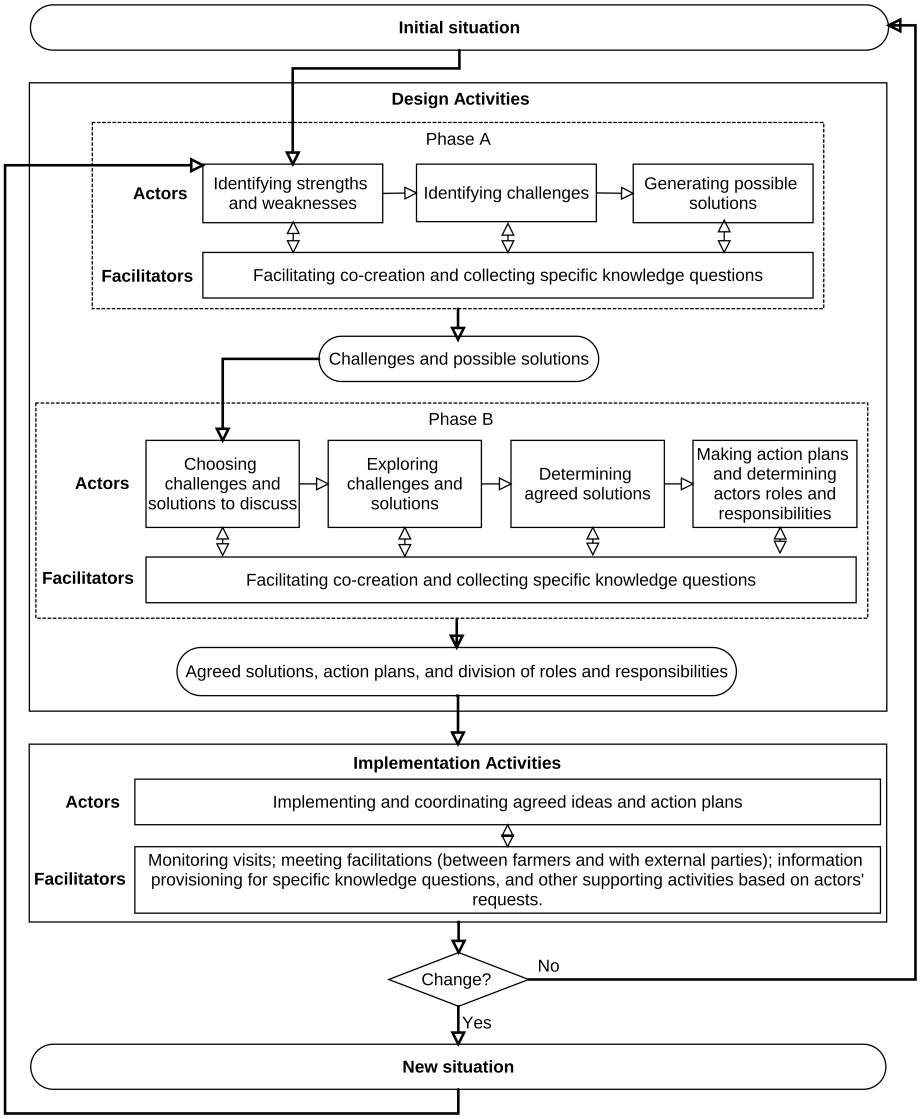

Figure 4.1: COCREATE: an approach to empower agricultural chain actors

which barriers they perceive in implementing the identified solutions, and the implications of implementing each of solutions. Discussions are documented by facilitators.

3. Determining agreed solutions.

   In this stage, participants come up with agreed solutions based on the discussions in the previous stage. The agreed solutions can be one of identified solutions or new solutions that emerge. Each time participants come up with an agreed solution, facilitators write the solutions on flipchart papers, confirming that all participants are in agreement.

4. Making action plans and determining the division of roles and responsibilities.

   In this stage, participants devise action plans for the solutions agreed in the previous stage. They each, in turn, propose plans for implementing the agreed solutions with as much detail as possible, and discuss feasibility. Once agreement has been reached on action plans, actors who will be responsible for the action plans are discussed and determined. Then, the action plans and the division of roles and responsibilities are written on flipchart papers together with their agreements.

The paraphrasing technique is applied continually. Rule in this technique is that when a participant is talking, other participants listen and are silent. Then, when another participant is going to talk, he/she has to paraphrase what the previous speaker has just said before he/she is allowed to contribute his/her ideas to the discussion.

In every stage in Phase A and Phase B, each group of participants is helped by, at least two facilitators. One of the main tasks of facilitators is to make sure the paraphrasing technique is consequently applied. In addition, facilitators help participants (who are not able) to write their ideas on post-it notes, encouraging silent participants to talk, making notes regarding the process and the content of the sessions, and documenting the process and the output. Facilitators all speak the local language and have knowledge of the local agricultural system.

Another role of facilitators is to provide information to answer specific knowledge questions asked by participants, for example which seeds are best for their situation, methods to measure pH of soil, procedure to establish a formal farmer group, etc. This information can be obtained by search on the Internet or other relevant sources, currently unavailable to these participants, on the basis of explicit request. The information is provided at the beginning of each session so that it can be taken into account by participants in the process of co-creation. The information is factual, and does not involve indications of solutions by the facilitators.

4.5.2. IMPLEMENTATION ACTIVITIES

During implementation activities participants (i.e. farmers, local traders) together pursue the solutions and action plans to which they have agreed. Facilitators play a role in: 1) organising meetings with external parties, e.g. extension officers, markets, government (on request); 2) visiting participants periodically (1-2 times a week) and inviting experts (when needed) to answer participants' specific knowledge questions.

After the implementation activities, follow-up design is performed. The follow-up design was conducted about 10-12 months after the last meeting of design activities. During follow-up design, participants identify barriers they have encountered and design and agree on new follow-up plans.

4.6. DISCUSSION AND CONCLUSION

This chapter proposes COCREATE as an approach to empower agricultural chain actors to pursue sustainable APSCs. COCREATE focuses on empowering agricultural chain actors to engage in designing and developing ways to improve their APSCs systems.

With respect to the types of actors whom participate in this approach, COCREATE involves multiple actors whom are connected not only horizontally but also vertically in the APSCs in which power imbalance exists. It enables participants to embrace the knowledge of multiple aspects of APSC otherwise unknown to them. In addition, COCREATE facilitates support by external actors to provide knowledge/information requested specifically by the participants.

With respect to empowerment, COCREATE is designed to improve participants' awareness of their capability to change through working together for which understanding of their own and others' situation is crucial.

With respect to its structure, COCREATE consists of design and implementation activities, and the process of these activities is cyclic with continuous feedback between the two. Design activities encompass the activities of identifying challenges and possible solutions, determining agreed solutions, action plans and the division of roles and responsibilities. Implementation activities encompass the activities of implementing agreed solutions and action plans determined in the design activities.

To support the empowerment in COCREATE, reflection through paraphrasing is one of the essential procedures. It supports participants in creating a common understanding of their situation as the basis for design solutions.

In COCREATE, participants are supported by facilitators to ensure the procedure of COCREATE (including paraphrase technique) is applied appropriately. In addition, the facilitators have a role in providing information and facilitating access to external actors when specifically requested by participants.

5

APSC SITUATION IN INDONESIA

This chapter describes agricultural production and supply chains (APSCs) in Indonesia, more specifically horticultural production and supply chains.

Section 5.1 provides the research method used to obtain information on APSCs in Indonesia. Section 5.2 describes the structure of APSCs, the chain governance between APSC actors and the challenges with which Indonesian APSCs are faced. Section 5.3 describes the two case studies performed in the context of this thesis in which COCREATE is implemented. Section 5.4 presents a conclusion.

5.1. METHOD

Information about APSCs situation in Indonesia discussed in this chapter was obtained from semi-structured interviews [1] with professionals in Indonesia, actors with knowledge of, and experience in, APSCs in the horticultural sector in Indonesia. The interview protocol is presented in Appendix 2

The 4 professionals interviewed represented the government, academic research, and industry, namely:

1. An Officer of Directorate General of Horticulture, Ministry of Agriculture of the Republic of Indonesia.
2. An Associate Professor from the Faculty of Agriculture, Padjadjaran University, Indonesia (Unpad).
3. An Assistant Professor from the School of Business and Management, Bandung Institute of Technology, Indonesia (ITB).
4. An employee of an Agricultural Technology Company in Indonesia.

The interviews were recorded (audio-recorded interviews), and transcribed. A summary of these transcripts was made.

[1] In line with the TU Delft Human Research Ethics (HRE) guidelines, approved.

The results of the interviews were then extended with insights from academic literature (i.e journal and conference papers), reports and documents on governmental law and regulation.

5.2. RESULTS

This section describes the general situation of APSCs in Indonesia, more specifically in the horticultural sector, based on the results of (1) interviews extended with (2) information from the literature. The summary of results of the interviews can be found in Appendix 3. Meanwhile, the transcripts of the interviews are provided in Appendix 4.

5.2.1. APSC STRUCTURE IN INDONESIA

Although there are various types of supply chain structure in the horticultural sector in Indonesia (reported by the interviewees), the main structure is: farmers-local traders-markets (traditional markets, supermarkets, exporters, horeca [2] and industries). This finding is in line with the structure of supply chains presented in Chapter 2 adapted from (Natawidjaja *et al.*, 2007a,b; Soviana and Puspa, 2012; Sunanto, 2013).

The interviews confirm that the number of farmers whom sell their products directly to markets is still small due to smallholder farmers' lack of knowledge and information about markets. The interviews also confirm that there are, however, smallholder farmers whom do sell their products to markets, especially to modern market players, through farmer organisations (FOs). Even though modern market players most often buy products from the local traders, they also have programmes of partnerships with FOs. In addition, in Indonesia, there is a rise in the number of agricultural technology (AgriTech) companies that build partnerships with FOs. These AgriTech companies sell their products directly to customers (through e-commerce systems), supermarkets, catering industry and export markets.

The interviews also indicated that there are large farming companies that organise farmers to supply produce. However, it is still very rare in the horticultural sector in Indonesia. Farming companies are business entities (state-owned and private), often plantations that produce palm oil, rubber, tee, cocoa and coffee [3]. Supply chain activities such as post-harvest, processing, market and distribution are most often integrated within the business.

Based on the explanation above, in the upstream, three types of APSCs are distinguished in this thesis: 1) local trader-farmer groups; 2) farmer organisations and 3) farming companies. Most smallholder farmers (93% of the total number of farmers in Indonesia) are members of local trader-farmer groups and farmer organisations.

As this thesis focuses on empowering smallholder farmers, COCREATE is evaluated for these two types of APSCs: local trader-farmers groups and farmer organisations. local trader-farmers groups and farmer organisations in the horticultural sector in Indonesia are discussed below.

[2] Hotel, restaurants and cafes

[3] https://www.indonesia-investments.com/culture/economy/general-economic-outline/agriculture/item378 (Accessed on 01 July 2020)

LOCAL TRADER-FARMER GROUP

A local trader-farmer group is a group of farmers whom are connected to a local trader in an APSC system through agreed chain governance between themselves (discussed in more detail in Section 5.2). This kind of relationship has existed for many decades (Natawidjaja *et al.*, 2007a). In a local trader-farmer group, one local trader is connected to many farmers (Figure 5.1).

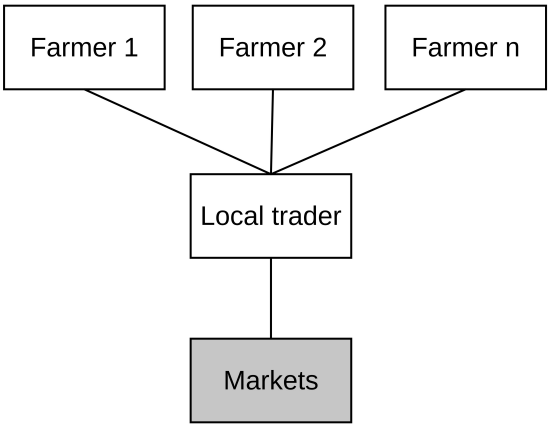

Figure 5.1: local trader-farmer group network

The interviews, confirm that most smallholder farmers in Indonesia are involved in this type of APSCs. Smallholder farmers very much depend on local traders to market their produce (horticultural products) as they often lack (access to) the knowledge needed to market their own produce. The produce local traders receive from smallholder farmers is ungraded. local traders are responsible for all post-harvest activities (cleaning, sorting, grading, packaging), needed before the produce is marketed. With respect to the market, local traders sell most produce (supplied by their farmers) to traditional markets, only a small share of their produce is sold to modern markets. This is in line with the works of (Natawidjaja *et al.*, 2007c,a)

With respect to access to agricultural land, even though there are farmers who have their own agricultural land, many smallholder farmers in Indonesia cultivate land owned by others, such as local traders, family and people who live in cities for whom different rental or profit-sharing schemes are in place (Natawidjaja *et al.*, 2007a). There are also smallholder farmers whom cultivate land owned by the government (e.g. land that is under the reign of the Ministry of the Forest) again with dedicated financial arrangements.

With respect to financial arrangements, based on the interview results, farmers whom work with local traders obtain credit from the local traders (explained in more detail in Section 5.2). As stated above access to knowledge and information is limited: there is lack of sharing information and knowledge (e.g. in market, production) from the local traders to farmers.

FARMER ORGANISATION

A farmer organisation (FO) is an organisation that facilitates farmers in collective actions, e.g., in production, market, transportation, finance (Arsyad *et al.*, 2018; Natawidjaja *et al.*, 2007a). Farmer organisations connect their members, most often smallholder farmers, horizontally. The type of governance within farmer organisations can differ: some aspects are determined by law (discussed in more detail in Chapter 5.2).

The interviews indicate that there are three types of farmer organisations (as mentioned in Chapter 2) in Indonesia: informal farmer groups, formal farmer groups and farmer cooperatives. Informal farmer groups connect farmers through local norms and culture (Kariuki and Place, 2005), and they work together based on incidental events, e.g. repairing irrigation channels, roads, helping each other if needed. Formal farmer groups have a formal structure and rules legalized by the government (Arsyad *et al.*, 2018; Kariuki and Place, 2005). They support farmers in APSC activities, most often, through programmes from, e.g. governments (including agricultural extension programmes), NGOs, universities (Arsyad *et al.*, 2018; Kariuki and Place, 2005). In Indonesia, based on governmental policy, formal farmer groups located in the same area can form a farmer group association (group of farmer groups). There is also a possibility that group of farmer groups are formed informally by the farmer groups who have common goals, e.g. getting and/or developing access to market. These hierarchies of farmer groups have been designed to support farmers in: 1) agricultural extension activities; 2) distributing government aids; and 3) partnerships with modern market players or AgriTech companies. Meanwhile, farmer cooperatives are business entities (corporations) legalized by the government that, to some extent, are independent in supporting their farmer members (even though they also have access to government programmes) (Kumar *et al.*, 2015; Owango *et al.*, 1998). A farmer group or a group of farmer groups can establish a farmer cooperative.

In Indonesia, in most cases, only formal farmer groups and farmer cooperatives support farmers in APSC activities. The structure of farmer organisations is depicted in Figure 5.2.

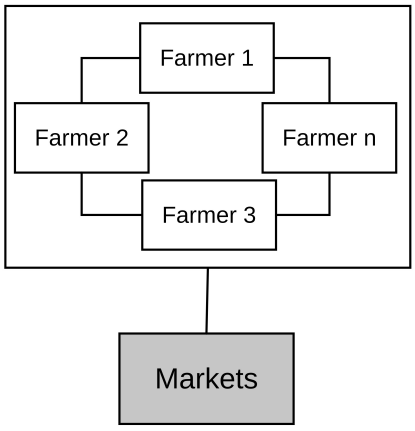

Figure 5.2: A network of farmers in a farmer organisation

With respect to markets, the interviews indicate that, FOs focus primarily on modern markets, such as supermarkets, export markets, horeca, industries and AgriTech companies, for which quality of produce needs to be consistently monitored. These market players, most often, require FOs to supply graded produce. For this, in most cases, FOs perform the post-harvest activities to fulfil the market requirements. This is in line with the works of (Arsyad *et al.*, 2018; Natawidjaja *et al.*, 2007a; van Der Laan *et al.*, 2016b,c).

With respect to access to agricultural land, the situation is similar to farmers who work with local traders. However, most often farmer members do not cultivate land owned by their local traders [4], unless the local traders are involved in the FOs, and appropriate agreements are in place.

With respect to financial arrangements, the interviews indicate that, if the organisations are formal farmer groups as described above, they have opportunities to acquire access to finance both from government and private companies. From the government, there are programmes, e.g. that supply tools and machines aids, fertilizer subsidy, credit, for formal farmer organisations. In some cases, private companies, such as modern market players and AgriTech companies provide credit in cash and production inputs for contract farming. This finding corresponds to the works of (Raya, 2016; van Der Laan *et al.*, 2016a).

Meanwhile, for farmer cooperatives, in addition to having access to government programmes, the status of corporation enables them to acquire access to formal funding institutions (e.g. commercial banks), and to cooperate with other corporations [5]. Even though FOs have the potential to improve smallholder farmers' position in APSCs, the interview confirm that there are still few FOs in the horticultural sector in Indonesia that successfully coordinate market access for their members that is in line with (Natawidjaja *et al.*, 2007a; Raya, 2016; Soviana and Puspa, 2012).

5.2.2. CHAIN GOVERNANCE IN APSCS IN INDONESIA

This section first describes chain governance between actors in local trader-farmer groups and farmer organisations in Indonesia, and then focuses on the chain governance of traditional markets, modern markets and AgriTech companies.

CHAIN GOVERNANCE OF LOCAL TRADER-FARMER GROUPS

The interviews indicate that within the APSCs, local traders have informal (verbal) contracts with their farmers. In these contracts, local traders provide credit (in cash or kind of input production, e.g. seed, fertilizers, pesticides) to farmers with the condition that the farmers are obliged to sell all their produce only to them. This finding is in line with (Karyani *et al.*, 2006; Natawidjaja *et al.*, 2007b,a).

On the one hand, this helps smallholder farmers because most face difficulty in finding capital for farming activities as they have little capital themselves and they have lack of access to credit from formal funding institutions. On the other hand farmers are obliged to sell their produce only to the same local trader affecting the bargaining position of farmers in selling their produce (Natawidjaja *et al.*, 2007a).

[4] In most cases, farmers cultivating land owned by local traders have to sell all their produce to the local traders
[5] Act of the Republic of Indonesia Number 17 of 2012 on Cooperatives

The interviews also confirm that, most often, the relationships between farmers and their local traders are very strong. This relationship is not only a business relationship but also a social relationship, as farmers can ask for a loan not only for farming activities but also for living. This makes it difficult for them to change their supply chain systems, e.g. joining farmer groups to have partnerships with modern market players on their own.

With respect to selling systems, as mentioned before, farmers deliver ungraded produce and local traders evaluate the quality of the produce and decide on the most appropriate market. The price farmers are paid by local traders is based on the price in the traditional market, even if produce is sold to the modern market (Natawidjaja *et al.*, 2007a,b). With respect to the payment system, the payment from the local traders to farmers is not in cash (about 1-7 days) (Karyani *et al.*, 2006; Natawidjaja *et al.*, 2007b,a; Yanagimura, 2018).

CHAIN GOVERNANCE OF FARMER ORGANISATIONS

Governance of farmer organisations (in particular, formal farmer groups and farmer cooperatives) can be distinguished into: governance ruled and legalized by the government; and, governance determined by the organisations themselves. Governance encompassing the procedure and the requirements for the establishment of FOs, FOs functions and business activities that are permitted, the requirements for farmer members and FOs management (e.g. head, secretaries), and monitoring of the FOs are ruled and legalized by the government for both, formal farmer groups [6] and farmer cooperatives [7]. Meanwhile, governance related to internal production and supply chains (discussed below) is determined by the organisations themselves.

The interviews indicate that FOs organise their farmer members to have partnerships with modern market players and/or AgriTech companies. Similar to local traders, there are modern market players and AgriTech companies that provide farmers (through FOs) credits in cash or in input production. The difference is that the price offered by these actors is fixed and more transparent. However, they require strict quality of produce, volume and schedule of supply. There are also modern market players and AgriTech companies that only buy products from FOs without providing credit.

To fulfil market requirements FOs have internal governance encompassing function divisions (e.g. production, post-harvest, transportation), price mechanisms (in line with contracts with markets), decision making on supply and market plans, and monitoring (Arsyad *et al.*, 2018). In most cases, farmer members supply produce to their FOs, and then the FOs perform post-harvest activities before selling the produce to markets (Natawidjaja *et al.*, 2007b). With respect to price, there are price mechanisms between farmer members and their FOs, such as price agreement in advance and profit-sharing system (Natawidjaja *et al.*, 2007b). Most farmers in FOs are more aware of the end market of their produce and its price (Natawidjaja *et al.*, 2007b).

With respect to access to knowledge and information, formal FOs can facilitate farmer members to acquire access to governmental agricultural extension programmes Arsyad

[6] Regulation of Ministry of Agriculture Republic of Indonesia, Number 82/Permentan/OT.140/8/2013 on Guidelines for the Development of Farmer Groups

[7] Act of the Republic of Indonesia Number 17 of 2012 on Cooperatives

et al. (2018). In fact, the interviews indicate that there are AgriTech companies whom organize an agricultural extension programmes for their FO partners.

CHAIN GOVERNANCE OF TRADITIONAL MARKETS, MODERN MARKETS AND AGRITECH COMPANIES

Traditional markets, modern markets and AgriTech companies, in general, implement the same governance in buying produce from local traders and farmer organisations. The chain governance of traditional markets, modern markets and AgriTech companies are explained below.

From the interviews, for traditional markets, there is no contract between traders in traditional markets and local traders and FOs. There are no or fewer volume restrictions and quality requirements for selling to the traditional markets. This finding corresponds to the works of (Chowdhury *et al.*, 2005; Natawidjaja *et al.*, 2007b; Yanagimura, 2018).The price mechanism is a market mechanism, and it is fluctuated. The price is higher when the amount of supply is lower, and vice versa (Chowdhury *et al.*, 2005). The payment mechanism in traditional market is often cash (Suryadarma *et al.*, 2010).

The interviews indicate that modern markets players (supermarkets, exporters, horeca, industries suppliers) have formal contracts with local traders and FOs to ensure that the modern market players acquire a continuous supply of high-quality produce. Contracts most often state specific commodities, qualities, order mechanism, payment systems and price mechanisms. However, the payment is not in cash, and usually takes 3-4 weeks after the produce is delivered. With respect to price, there is a price agreement between the modern market players and local traders and FOs. On average, modern market prices are higher and more stable (price variance is small) than traditional market prices. This finding is in line with the works of (Natawidjaja *et al.*, 2007b,a; Sunanto, 2013; Yanagimura, 2018).

The interviews indicate that AgriTech companies also have contracts with local traders and FOs (similar to the contracts of modern market players). There are AgriTech companies that require specific graded products, but there are also AgriTech companies that buy ungraded products. In addition to their role in the market, there are AgriTech companies who also have roles in finance and extension programmes (as mentioned above). With respect to finance, credit provided by AgriTech companies follows the rules from the finance authority (part of the government), e.g. the maximum amount of credit per farmer, interest rate, administrative procedures. Even though it is not as easy as getting credit from the local traders, it is easier than getting credit from the commercial banks (e.g. collateral is not needed). With respect to extension programmes, to improve produce quality of their partner FOs, AgriTech companies collaborate with production inputs companies (seeds, fertilisers, pesticides), universities and the government to conduct extension programmes through field experiments and weekly visits and monitoring.

The interviews indicate that with respect to food safety only export market players are concerned. They follow the food safety standard as required by their buyers. Meanwhile, traditional markets, other modern market players, and AgriTech companies are less concerned. These parties determine the quality of produce based primarily on only outer quality, i.e. size, shape and appearances. There is no control for pesticide residues of produce also noted by (Natawidjaja *et al.*, 2007a; Yanagimura, 2018).

5.2.3. CHALLENGES IN INDONESIAN APSCS

In general, the challenges Indonesian horticultural production and supply chains face, are similar to those in other developing countries. The interviews indicate that the challenges of Indonesian horticultural supply chains encompass aspects related to production, market, logistics, finance, capacity development and institutions.

With respect to production, the challenges encompass low quality and productivity, seeds availability, and poor production systems. Low quality and low productivity are related to characteristics of most farmers in Indonesia whom are smallholder farmers with lack of knowledge and capital to implement good farming practices (Abdulsamad *et al.*, 2015; Menegay and Darmono, 2007; Perdana and Kusnandar, 2012). With respect to seeds, the seeds for horticultural crops are often not available, as most are imported. Meanwhile, from production systems, most farmers do not have the production plan, planting, harvesting and supply schedule to match the production with markets.

Meanwhile with respect to the market, as explained above, most smallholder farmers are controlled by the local traders in financial and (for some farmers) land (Natawidjaja *et al.*, 2007a, 2014; Soviana and Puspa, 2012). The interviews confirm that this situation leads to the challenges of power imbalance, lack of transparency, and unfair chain governance in line with the findings of Natawidjaja *et al.* (2007a, 2014); Soviana and Puspa (2012). The majority of produce goes to traditional markets: unstructured markets characterised by lower requirements with respect to quality, volume and schedule of supply. There is little or no incentive for farmers to increase their produce quality.

With respect to logistics, the main challenge reported is the absence of cold chain systems for horticultural products resulting in high food losses and food waste. The other challenge is the high cost of delivery of produce in long-chain systems.

With respect to finance, there is the lack of financial infrastructures for farmers that lead to their dependencies on the local traders (explained above). Even though there is a credit programme from the government, the number of farmers who can access this program is still limited.

With respect to capacity development, the governmental agricultural extension programmes are still struggling to support farmers due to the insufficient number of officers and lack of trust from farmers. In addition, the extension programmes still follow the top-down approach that, most often, do not solve the farmers' problems and still focus solely on the production aspect. Even though there are extension programmes from AgriTech companies (as explained above), access is limited to their partners.

With respect to governance, the first challenge is in the chain governance between actors, especially between farmers and local traders with less transparent information and unequal margin distribution. Second, there are a few farmer groups whom are able to facilitate farmers to do collective actions in the production and supply chains. Third, government policy does not focus on the horticultural sector.

5.3. CASE STUDIES WITH COCREATE

In this thesis, COCREATE is implemented in two case studies, one for each of the two types of APSCs in Indonesia: local trader-farmer groups, and 2) a farmer organisation, more specifically a group of farmer groups. Both cases are located in a horticultural production centre in Indonesia, in the Bandung district (in different sub-districts), West

Java. This area is exemplary for most agricultural chains in Indonesia in terms of challenges explained above (Menegay and Darmono, 2007; Natawidjaja and Morgan, 2007; Natawidjaja *et al.*, 2007a, 2014).

These case studies were performed in collaboration with a local university in Indonesia, with Study Programme of Agribusiness, Faculty of Agriculture, of Padjadjaran University (Unpad). Unpad is a local university with many educational programmes in agricultural sector in West Java, Indonesia, with knowledge of the local situations and also access to farmers and local traders.

5.3.1. CASE OF LOCAL TRADER-FARMER GROUPS IN CIWIDEY

The first case study with local trader-farmer groups was located in the Ciwidey subdistrict in Bandung District, West Java. The information about the case of local trader-farmer groups is discussed in more detail in Chapter 6.

As explained above, there are many problems in the relations between farmers and local traders. Meanwhile, they depend on each other. Farmers depend on local traders to market their produce and to acquire credit, while the local traders depend on the farmers for continuous supply of good quality produce. However, the interviews indicate a lack of incentive alignment in their relationships. local traders have difficulty to motivate farmers to improve their produce quality due to the implemented selling systems (ungraded) and lack of transparency (e.g. in price, logistic cost). On the other hand, the interviews indicate lack of commitment of farmers to the agreements as one the main problem in APSCs in Indonesia, including their agreements with their local traders.

COCREATE is implemented with local trader-farmers groups to empower farmers and local traders to improve their understanding on their own and others' situations, to find ways to deal with their situations and to work together to improve each other position in their APSCs.

5.3.2. CASE OF A GROUP OF FARMER GROUPS IN PANGALENGAN

The second case study is performed with a group of farmer groups (GFG) located in Pangalengan sub-district, Bandung District, West Java. This GFG consists of smaller farmer groups located in the same area, some of which are formal farmer groups. The information about the GFG of Pangalengan is discussed in more detail in Chapter 7.

As explained above, FOs can facilitate smallholder farmers to acquire access to markets, especially modern markets that require high quality produce. However, as the interviews indicate, there are many government programmes of FOs and market access development that have not been successful. Many FOs cannot maintain their organisations and their partnership with modern market players.

The interviews identified challenges faced in FOs development in Indonesia. First, there is a lack of common goals between farmer members. The top-down approach inherent in the programmes is believed to be one of the factors involved Beber *et al.* (2018); Markelova *et al.* (2009). Second, as mentioned above, there is a lack of commitment of farmer members to their FOs. When the price is high, most often they sell their produce to the local traders who offer the highest price. Third, there is usually the domination of the head of FOs that lead to unequal profit distributions. Fourth, most farmers, especially the old farmers, lack entrepreneurial spirits to take risks to innovate. Meanwhile,

to supply to modern markets, the improvement of production and supply chain systems are required. Fifth, the government programmes in FOs development focus on forming farmer groups, but less focus on empowering farmers to develop their APSCs.

COCREATE is implemented with the GFG of Pangalengan to empower farmers involved in this group to improve common understanding of their situation (as a group) and to self-organise their governance to deal with the encountered challenges (discussed in more detail in Chapter 7).

5.4. CONCLUSION

This section discusses the general situation of Indonesian APSCs, in the horticultural sector. Three types of APSCs are distinguished in this thesis: local trader-farmer group, farmer organisation, and farming companies. This research focuses on the first two types, as they represent most smallholder farmers in Indonesia.

In local trader-farmer groups, farmers very much depend on their local traders, both for market access and in farming activities (through credit). This kind of APSC is characterised by the low quality of produce (due to lack of knowledge of and capital owned by farmers) and lack of transparency in market information: end market and price.

In farmer organisations, meanwhile, farmers are encouraged to be more aware of produce quality, and there is more transparent market information. However, there are still few farmer organisations in horticultural sector in Indonesia.

6

COCREATE IMPLEMENTATION WITH AGRICULTURAL CHAIN ACTORS CONNECTED VERTICALLY: IMPROVING RELATION BETWEEN FARMERS AND LOCAL TRADERS

COCREATE, an approach to empower agricultural chain actors to pursue sustainable APSCs in developing countries, has been designed and proposed in Chapter 4. COCREATE focuses on empowering agricultural chain actors to engage in pursuing common understanding of their situation, designing and developing solutions (by themselves) to deal with specific situations, and implementing solutions (through working together) to pursue sustainable APSCs.

This chapter addresses the third research questions: "Can COCREATE be implemented to improve the vertical relation of agricultural chain actors in Indonesia?", and "What are the effects of the implementation of COCREATE on the situation of the cases with respect to vertical relations in agricultural production and supply chains?".

To this purpose, COCREATE was implemented with agricultural chain actors connected vertically, more specifically with local trader-farmer groups. Although farmers

This chapter is based on:

1. Kusnandar, K., van Kooten, O., & Brazier, F. M. (2019). Empowering through reflection: Participatory design of change in agricultural chains in indonesia by local stakeholders. *Cogent Food & Agriculture*, 5(1), 1608685. https://doi.org/10.1080/23311932.2019.1608685
2. Kusnandar, K., van Kooten, O., & Brazier, F. M. (2020). COCREATE: A Self-directed Learning Approach to Agricultural Extension Programmes. *Accepted in Development in Practice (November 2020)*

and local traders are fully dependent on each other, there is often little awareness of the challenges with which they are each faced. It was the main reason to focus on this vertical connection in this thesis (discussed in Chapter 5).

Section 6.1 discusses the method of COCREATE implementation with farmers and local traders. Section 6.2 presents the results of design activities, implementation activities and follow-up design. Section 6.3 provides a discussion and conclusion.

6.1. METHOD

A case study in a horticultural production centre in Indonesia, Ciwidey sub-district, Bandung district, West Java was performed in this action research. Four local trader-farmer groups from this area participated in COCREATE implementation.

The method of COCREATE implementation with local trader-farmer groups is discussed below.

6.1.1. MOCK-UP SESSION

Ten researchers and research assistants from the Department of Agribusiness, Faculty of Agriculture, Padjadjaran University, were trained during two mock-up sessions to master the procedure and reflection technique required for COCREATE to facilitate the co-creation workshops (explained in Chapter 4).

6.1.2. SETTING

As discussed in Chapter 5, local traders are connected vertically to their farmers through traditional chain governance. In short, local traders provide credit to farmers, take care of all post-harvest activities (cleaning, sorting and grading), and choice of market: most often the traditional market. Meanwhile, farmers have an obligation to sell all their produce to their local traders.

There are 4 local trader-farmer groups whom participated in COCREATE implementation in this study. Actually, first, there were 6 local traders who were willing to participate, but then two local traders discontinued their participations. The numbers of farmers whom worked with the four local traders and participated in COCREATE are provided in Table 6.1

Table 6.1: The number of farmers who work with the local traders who participated in COCREATE

	Number of farmers
local trader 1	15
local trader 2	34
local trader 3	25
local trader 4	32

Note: The other two local traders (who did not continue their participation in COCREATE) did not mention the number of farmers who work with them

With respect kind of crops, the horticultural crops cultivated by these farmers include watercress, tomatoes, beans, cabbage, chillies, leafy green vegetables.

6.1.3. COCREATE IMPLEMENTATION

A series of COCREATE workshops was implemented between April 2017 and April 2018 with local trader-farmer groups. The implementation of each activity is explained below.

DESIGN ACTIVITIES

Design activities encompassing a series of co-creation workshops with local trader-farmer groups were conducted from April to June 2017. The location of workshops was determined together with the farmers and local traders close to their home. Each workshop took about a half day, with about a week between workshops to ensure that workshops do not disturb farmers' and local traders' activities too extensively whilst maintaining momentum between workshops.

The procedure described in Chapter 4 was implemented as follows:

1. Phase A

   In Phase A, two workshops were organised for the farmers, and two for the local traders. The first workshop focussed on identifying strengths, weaknesses and challenges. Two rounds were organised for the farmers: first with groups of farmers on the basis of their connection to specific local traders, and then with mixed groups of farmers (associated with different local traders). Note that there was only one round during the first workshop for the local trader group. The second workshop focused on generating possible solutions for identified challenges with these same groups (with separate workshops for farmers and local traders).

2. Phase B

   In phase B, two workshops were organised with farmers and local traders together. Groups were formed on the basis of local trader-farmer groups (farmers together with their local trader) to work together to determine solutions, action plans, and actors in-charge for the action plans.

   The first workshop began by local traders presenting their challenges and possible solutions identified in the previous workshops to "their" farmers, and vice versa. Together they focused on choosing challenges and solutions to be discussed, exploring challenges and solutions, and determining agreed solutions. Specific knowledge questions to be addressed were noted.

   Then, the second workshop started by facilitators answering the knowledge questions from the first workshop. Before moving to the next stage, groups reconsider the results of the previous workshop (challenges and agreed solutions) in light of the new information they have received. The new list of challenges and agreed solutions on the flipchart are the basis for discussion and choice of plans of action and actors in-charge in the action plans.

IMPLEMENTATION ACTIVITIES

The implementation of solutions and action plans agreed in the design activities were performed between July 2017 and April 2018. Two facilitators [1] visited the groups in the case study area, at least, 1-2 times a week for a period of 5 months, from August to

[1] Students from Unpad supported by research assistants and lecturers from Unpad and TU-Delft

December after which, from January to March, less frequent visits, 1-2 times a month, were held plus additional meetings with extension officers and other experts to address specific needs and desires of local traders and farmers.

FOLLOW-UP DESIGN

Two follow-up design workshops were held in April 2018. These workshops were supported by facilitators [2]. In these workshops, local trader-farmer groups, in each group, identified the changes in situations due to the implementation of agreed solutions, identified barriers in the implementation of solutions, and design and agree on new follow-up plans.

In the follow-up design workshop an agricultural extension officer was invited to answer specific questions as requested by the farmers and local traders.

6.1.4. PARTICIPANTS OF COCREATE

DESIGN ACTIVITIES

In Phase A, 6 local traders participated in the first workshop with local traders only, after which only 4 local traders continued. The four groups of farmers associated with these 4 local traders were invited to participate in this case study, initially for the first and second workshops for farmers only described above; they accepted the invitation and attended the workshops.

In Phase B, the 4 local traders and most of these farmers (whom participated in Phase A) also participated in the first and second workshop with farmers and local traders.

The composition of the groups in both Phase A and Phase B are depicted below in Table 6.2. Note that there is some variance in the number of farmers per group.

Table 6.2: The number of participants in the design activities

	Phase A		Phase B	
	Workshop 1	Workshop 2	Workshop 1	Workshop 2
Workshop with local trader				
local traders	6	4		
Workshop with groups of farmers				
Group 1	8	11		
Group 2	7	9		
Group 3	3	7		
Group 4	7	8		
Total	*25*	*35*		
Workshop with local trader-farmer groups				
Group 1			10	8
Group 2			9	10
Group 3			8	10
Group 4			10	9
Total			*37*	*37*

Note: in every workshop, each group was supported by 2 facilitators

[2] Research assistants from Unpad and a researcher from TU Delft (the author of this thesis)

IMPLEMENTATION ACTIVITIES AND FOLLOW-UP DESIGN

The local traders and farmers in Groups 1 and 2 participated in the design activities, implementation and follow-up design activities. The farmers in Group 3 did the same. The local trader in Group 3, however, ended participation in the workshops after the design activities. The same held for both the farmers and the local trader in Group 4: they too ended participation in the case study after the design activities workshops.

Table 6.3 depicts the number of participants in the implementation activities and follow-up design.

Table 6.3: Number of participants in the implementation and follow-up design

	Implementation activities	Follow-up design	
		First workshop	Second workshop
Group 1	13	7	6
Group 2	22	9	8
Group 3	11	3	7
Total	46	19	21

Note: in every workshop, each group was supported by 2 facilitators

6.2. RESULTS

This section provides the results of COCREATE implementation with the local trader-farmer groups. The process and the output of COCREATE are explained below. The results of the design activities workshops are presented first followed by the results of implementation activities and follow-up design.

6.2.1. RESULTS OF DESIGN ACTIVITIES

The results of design activities are divided into the process and the output that are provided below.

THE PROCESS OF DESIGN ACTIVITIES

1. Phase A

   In the first workshop of phase A, with separate workshops for local traders and farmers, more weaknesses than strengths were identified (Table 6.4). On average, local traders each identified 1-2 strengths and 4 weaknesses, of which half were categorised to be unique. Farmers in three groups (1, 2, and 4), on average each identified 3-4 strengths and 4-5 weaknesses. Farmers in Group 3 identified on average approx. 13 strengths and 17 weaknesses. For each of these groups about 30-47% were categorised to be unique strengths and weakness.

   In the second round of identifying strengths and weaknesses (workshop with groups of farmers), there was an increase in the average of number of post-its written by farmers. On average, each farmer identified 3-6 strengths and 4-7 weaknesses, and about 30-60% of these post-its were identified as unique strengths and weaknesses in each group. In this round, one common weakness emerged, that is the lack of access to

agricultural extension services. In the first round, this weakness had only been named in two groups, then, in the second round, it was mentioned by all groups.

In the round of identified challenges, the identified strengths and weaknesses were discussed in separate workshops by the 4 groups of farmers and the group of local traders. From these discussions, 11 main challenges were identified by local traders, and 10-15 main challenges were identified by each group of farmers (Table 6.4).

Table 6.4: Number of strengths, weaknesses and challenges identified in the first workshop of phase A

	Number of participants	Number of post-it		Unique		Challenges
		Strength	Weakness	Strength	Weakness	
Workshop with local traders	6	10	24	6	13	11
Workshop with farmers (first round)						
Group 1	8	31	43	10	12	10
Group 2	7	21	38	10	17	15
Group 3	3	41	52	14	18	15
Group 4	7	23	31	9	13	13
Workshop with farmers (second round)						
Mixed group 1	7	31	27	11	14	
Mixed group 2	7	25	31	12	15	
Mixed group 3	7	35	51	18	16	
Mixed group 4	4	24	27	16	15	

In the second workshop of phase A, in the round of generating possible solutions with local traders, on average, 9 solutions were identified by each local trader. After categorisation, about 37% of written post-its were considered to be unique (see Table 6.5). Meanwhile in the round of generating possible solutions with farmers, in three groups (1, 2, and 4), on average, each farmer identified 4-5 possible solutions, and in the group 3 each farmer identified on average 10 solutions. After categorisation, about 25-40% were identified to be unique.

Table 6.5: Number of ideas created in the second workshop of phase A

	Number of participants	Number of	
		Post its of solutions	Unique solutions
Workshop with local traders	4	37	14
Workshop with farmers			
Farmers of Group 1	11	42	12
Farmers of Group 2	9	45	19
Farmers of Group 3	7	70	17
Farmers of Group 4	8	43	17

2. Phase B

In the workshops of phase B with local trader-farmer groups (local traders work together with their farmers in each group), paraphrasing was initially a challenge (requiring facilitators to interrupt), but was applied strictly. In the first workshop, every local trader-farmer group agreed on 3-6 solutions (Table 6.6).

Table 6.6: Number of agreed solutions resulted in the first workshop of Phase B

	Number of participants	Agreed solutions
Group 1	10	3
Group 2	9	5
Group 3	8	3
Group 4	10	6

In the second workshop of Phase B, first facilitators answered the specific knowledge questions posed during the first workshop at the beginning of the second workshop of Phase B.

In this workshop, in general, in each local trader-farmer group, there was an increase in the number of agreed solutions. On average, in each group, action plans were devised less than half of the agreed solutions (see Table 6.7)

Table 6.7: Number of agreed solutions, action plans, and actors in-charge resulted in the second workshops of phase B

	Number of participants	Number of agreed solutions	Number of action plans
Group 1	8	5	3
Group 2	10	9	4
Group 3	10	8	2
Group 4	9	7	2

THE OUTPUT OF DESIGN ACTIVITIES

1. Phase A

   Challenges and solutions resulted from the Phase A of design activities were categorised by researchers based on their relation to agricultural chains: production, market, logistics and transportation infrastructures, financial infrastructures, and institutions, for the purpose of analysis.

   Challenges named by local traders with respect to market include price, payment and order system, and access of information. With respect to production, the main challenge named by local traders is low quality of produce supplied by farmers. Other main challenges are the (lack of) commitment of farmers bounded by credit, access to formal credit, and access to governmental programmes. The main challenges faced by local traders are listed in Appendix 5.

   Meanwhile, farmers first named challenges with respect to production encompassing low yield and quality of crops, soil condition, pests and diseases, access to good quality of production inputs, water shortage in dry season, and competition in getting farming labour and renting land. The main challenges named with respect to the

market are market access, price fluctuation, access to market information, and payment system from local traders. Other main challenges include high transportation cost related to bad condition of road connected their lands, lack of capital and access to formal credit, lack of access to agricultural extension services and government programs, and the absence of farmer organisation. The main challenges of farmers are listed in Appendix 6.

With respect to possible solutions, most possible solutions generated by local traders deal with challenges in logistics, that is to control supply from farmers bounded by them through credit. It encompasses farmer selection, record keeping and negotiation. Solutions to deal with market challenges are negotiation with buyers and new strategies for volume of supply. Meanwhile, for challenges in production related to produce quality, a solution would be to encourage farmer to use better farming methods and to use better quality production inputs (seeds, fertilizers). Other solutions are to access to formal credit and to establish a formal farmer group to acquire access to governmental programmes (see Appendix 5).

Meanwhile, for farmers, more than half of the possible solutions relate to challenges in production. They include farming methods, crop maintenance, maintaining soil quality, producing better seeds, fertilizing, spraying, getting access to production inputs, managing water and labour. Solutions to deal with market challenges are contract and transparency in price from local traders, planning in farming coordinated by local trader, expansion of local traders' markets, and government policy in market and price. Meanwhile, solutions to deal with financial challenges are establishing cooperation, and managing and controlling money for farming. The other solutions are related to improving roads connected their land and establishing formal farmer groups to get access to agricultural extension services and government programs (See Appendix 6).

2. Phase B

   In Phase B, local traders worked together with their farmers, in each group, to discuss the important challenges and to determine the solutions to deal with the challenges.

   Solutions agreed by local trader-farmer groups addressed challenges in production, market, logistics and transportation, financial, and institutions. The challenges, agreed solutions and action plans resulted from the design activities are provided in the Table 6.8

Table 6.8: The challenges, agreed solutions and action plans resulted from the design activities

Challenges	Agreed Solutions and action plans
Production	
Group 1	
Pests and diseases	Using kipahit leaves[1]
Cost and availability of fertilisers	Acquiring access to subsidy programmes (linked to institutions)
Water shortage in dry season	Group provides and manages water pump - The local trader will provide water pump - Farmers will be responsible for operational and maintenance costs

Continued...

Table 6.8(continued)

Challenges	Agreed Solutions and action plans
Group 2	
Low yield and quality of produce	Conducting field experiments - Farmers will provide land and labour - The local trader will provide good quality production inputs (with credit scheme) and technical assistance
Pests and diseases	Improving spraying method (part of field experiments)
Water shortage in dry season	Working together to maintain irrigation channels
Group 3	
Low quality of produce	Improving farming method
Unknown soil pH	Using turmeric
Water shortage in dry season	Working together to maintain irrigation channels
Labour shortage in rainy season	Changing schedule of farming activities
Group 4	
Pest and diseases	–
Low yield and quality of produce.	Conducting field experiments - Farmers will provide labour - The local trader will provide land
Water shortage in dry season	Farmers and the local trader (as a group) will buy water pump
Labour shortage in rainy season	Finding labour from outside area
Market	
Group 1	
Low price of produce	Supplying packaged produce to supermarkets - Farmers will be involved in post-harvest activities[2] - The local trader will be responsible for market and transportation
Group 2	
Price fluctuation	Supplying packaged produce to supermarkets - Farmers will be responsible for supplying good quality produce - The local trader will be responsible for post-harvest activities, market and transportation
No planning in planting crops	Making a planting schedule - The local trader will make a planting schedule - Farmers will follow the schedule
Group 3	
Price fluctuation	Supplying packaged produce to supermarkets
No planning in planting crops	Making a planting schedule
Groups 4	
Price fluctuation	Supplying packaged produce to supermarkets.
Logistics and transportation	
Group 2 and 3	
Bad condition of roads	Working together to maintain roads
Group 4	
Bad condition of roads	Request support to the government
Financial	
Group 2	
Lack of access to formal funding institutions	The local trader will continue to provide credit

Continued...

Table 6.8(continued)

Challenges	Agreed Solutions and action plans
Managing money for farming and living	Separating money for farming and living
Group 3	
Lack of capital	Trying to acquire credit from family, neighbours/friends and the government
Group 4	
The absence of record keeping of credit from local trader to farmers	One farmer is appointed to help the local trader to make record keeping of credit for farmers
Institutions	
Group 1	
Lack of access to government programmes	Establishing a formal farmer group - Further group meetings - One farmer is appointed to collect data and documents required in the process of formalisation - Farmers and the local trader will contribute to administrative cost
Lack of means for sharing information	"as above"
Group 2	
Lack of access to government programmes	Establishing a formal farmer group - Further group meetings - The local trader will collect data and documents required for the process of formalisation - Farmers and the local trader will contribute to administrative cost
The absence of a formal farmer group	"as above"
Group 3	
Lack of access to government programmes	Establishing a formal farmer group - One farmer is appointed to collect data and documents required in the process of formalisation - Farmers will contribute to administrative cost
The absence of a formal farmer group	"as above"
group 4	
Lack of access to government programmes	Establishing a formal farmer group - Further group meetings - One farmer is appointed to organise the further meetings
The absence of a formal farmer group	"as above"

[1] A local name for Thitonia difersivolia
[2] i.e. cleaning, sorting, grading and packaging

6.2.2. RESULTS OF IMPLEMENTATION ACTIVITIES AND FOLLOW-UP DESIGN

As mentioned above, 3 groups (Group 1, 2 and 3) continued their participation in the implementation activities and follow-design. This section provides the results of imple-

mentation activities and follow-up design of these three groups.

During the implementation activities the groups: 1) held informal meetings among themselves to discuss farming methods; 2) contacted supermarkets to acquire access to these markets; and 3) held meetings with extension officers and local government to form formal farmers groups. As indicated above follow-up design meetings were held after approx. 10 months supported by facilitators and an agricultural extension officer was invited to a meeting on specific request of farmers and local traders.

The results of implementation activities and follow-up design are described below for APSCs in relation to production, market, logistics, finance, and institutions.

PRODUCTION

Farmers and local traders were mostly successful in implementing their plans and discovered limitations during the process (Table 6.9). The plans, then, were adapted (during the follow-up design meetings) based on their experience (during implementation activities) and new technical knowledge gained from interaction with an agricultural extension officer.

MARKET

With respect to the market, all groups pursued the option to supply produce to supermarkets. Initially, all groups were unsuccessful. Groups 1 and 2 pursued and were successful, while Group 3 did not pursue this any further. As of November 2018, Groups 1 and 2 are working with a supermarket supplier to supply produce to two supermarkets with a total of 11 outlets [3]. Farmers are involved in post-harvest activities and have access to market information [4] that affect their awareness on produce quality and the implications for market value. In the follow-up design, Groups 1 and 2 have plans to increase their supply to supermarkets, while Group 3 are pursuing opportunities to expand their market.

Table 6.10 shows how agreed solutions and action plans have been implemented, and the follow-up plans of all groups with respect to the market.

[3] In 2020, the Group 1 and 2 managed to maintain their access to modern markets, even though through different suppliers. In fact, the two groups have been successful in obtaining a government programme in coffee development (as their secondary crops)

[4] The two local traders share information on price, volume order, post-harvest and transportation cost of produce supplied to supermarkets with the farmers

Table 6.9: Implementation of agreed solutions and actions plans, and follow-up plans with respect to production

Agreed solutions and action plans	Implementation	Follow-up plans
Group 1		
Using kipahit leaves	Farmers applied the kipahit method, but the availability of the leaves was limited	Using bamboo to deal with snails[1].
Acquiring access to subsidy programmes	The group has established a formal farmer group to acquire access to subsidy programmes	Accessing a fertiliser subsidy programme from the government
Using water pump - The local trader will provide a water pump - Farmers will be responsible for operational and maintenance costs	The group cancelled the plan because the flow of water from the sources is very limited.	Planting crops that need less water
Group 2		
Conducting field experiments - Farmers will provide land and labour - The local trader will provide good quality production inputs (with a credit scheme) and technical assistance	Farmers and the local trader had informal discussions to improve farming practices, then farmers applied a new method, but the result was under expectation.	Accessing training from agricultural extension programmes[2]
Improving spraying method (part of field experiments)	Farmers applied a new spraying method, but it was not successful	Using bamboo to deal with snails
Working together to maintain irrigation channels	Farmers continue to work together to maintain irrigation channels.	Keeping up the activity
Group 3		
Improving farming method	Farmers tried to improve their farming method, but it was not successful	Using better quality of production inputs (seeds, fertilisers, pesticides)
Using turmeric	Farmers applied the turmeric method successfully, and the pH of their soil is still in the normal range	Keeping up the activity
Working together to maintain irrigation channels	Farmers continue to work together to maintain irrigation channels.	Keeping up the activity
Changing schedule of farming activities	Farmers adjusted the schedule of farming activities and managed to do some activities by themselves	Keeping up the activity

[1] One of traditional methods informed by the agricultural extension officer
[2] Related to their farmer group status that is discussed in institutions

Table 6.10: Implementation of agreed solutions and action plans, and follow-up plans with respect to the market

Agreed solutions and action plans	Implementation	Follow-up plans
Group 1		
Supplying packaged produce to supermarkets - Farmers will be involved in post-harvest activities - The local trader will be responsible for market and transportation	The group has supplied produce to supermarkets - Farmers have been involved in post-harvest activities, and the local trader is responsible for market and transportation	Two plans - Farmers will improve produce quality - The local trader will acquire up-to-date market information from supermarkets
Group 2		
Supplying packaged produce to supermarkets - Farmers will be responsible for supplying good quality produce - The local trader will be responsible for post-harvest activities, market and transportation	The group has supplied produce to supermarkets - Farmers have been involved in post-harvest activities, and the local trader is responsible for market and transportation	Expanding their market, both for high-grade and low-grade produce
Making a planting schedule - The local trader will make a planting schedule - Farmers will follow the schedule	The group has not implemented a planting schedule due to limited volume ordered from supermarkets	Implementing a planting schedule when market demand has increased - The local trader will make a planting schedule - Farmers will follow the schedule
Group 3		
Supplying packaged produce to supermarkets	The group prepared and sent samples of produce to a supermarket, but it was not accepted	Finding other opportunities to expand their market
Making a planting schedule	The group has not implemented a planting schedule	Identifying the kind of produce needed by markets before making plans for planting crops

LOGISTICS

With respect to logistics, farmers continue to work together to fix roads connecting their land. However, because most roads are not paved, they are easily damaged. For this, they came up with follow-up plans to pave the roads and to ask for support from the local government (Table 6.11).

FINANCE

Little has changed for all three groups with respect to finance (Table 6.12). In the follow-up design, Group 3 agreed to try to acquire access to finance from the government. This requires the status of formal farmer group (discussed in the institutions).

Table 6.11: Implementation of agreed solutions and action plans, and follow-up plans with respect to logistics

Agreed solutions and action plans	Implementation	Follow-up plans
Group 2		
Working together to maintain roads	Farmers continue to work together to fix roads	Farmers and the local traders will contribute to the cost of paving roads, in addition to working together
Group 3		
Working together to maintain roads	Farmers continue to work together to fix roads	Two plans - Farmers will contribute to the cost of paving roads, in addition to working together - Applying proposal to the local government

Table 6.12: Implementation of agreed solutions and action plans, and follow-up plans with respect to finance

Agreed solutions and action plans	Implementation	Follow-up plans
Group 2		
The local trader will continue to provide farmers credit	The local trader continues to provide farmers credit	Keeping up the activity
Separating money for farming and living	Farmers have tried to separate money for farming and living	Keeping up the activit
Group 3		
Finding access to credit - Trying to acquire credit from family, neighbours/friends and the government	Farmers have not been successful in acquiring credit access	Applying to a government credit programme that requires a formal farmer group [1]

[1] Proposed by the agricultural extension officer

INSTITUTIONS

With respect to institutions, all groups pursued formalisation of their group. As of November 2019, Groups 1 and 2 have been registered in the database of the Ministry of Agriculture and have acquired a formal organisational structure. Meanwhile, due to regulations [5] farmers in Group 3 needed to re-join an established farmer group of coffee growers (of which they were previously members). Negotiations to this purpose were successful [6].

Implementation of agreed solutions and action plans, and follow-up plans with respect to institutions are shown in Table 6.13.

[5] Based on the rules, farmers who are registered in a formal farmer group cannot become a member of a new farmer group

[6] The head of coffee farmer group came to the follow-up design meeting invited by Group 3 and accepted the plans

Table 6.13: Implementation of agreed solutions and action plans, and follow-up plans with respect to institutions

Agreed solutions and action plans	Implementation	Follow-up plans
Group 1 and 2 Establishing a formal farmer group - Further group meetings - One farmer is appointed to collect data and documents required in the process of formalisation - Farmers and the local trader will contribute to administrative cost	The group has processed the legalisation of farmer group, but the process at the level of the local government has not been finished yet - The group had internal meetings and a meeting with an agricultural extension officer - The group has collected and sent required documents to the local government - A formal organisational structure has been defined and implemented	Keeping in touch with the local government to acquire up-to-date information regarding the process of legalisation - The local trader and farmers in the management of farmer group will be responsible for this
Group 3 Establishing a formal farmer group - One farmer is appointed to collect data and documents required in the process of formalisation - Farmers and the local trader will contribute to administrative cost	The group tried to establish a formal farmer group, but most farmers have been registered to an established farmer group (a coffee farmer group)	Reorganising the group by - Joining the coffee farmer group - Forming a vegetable division and appointing one farmer as a coordinator

6.3. DISCUSSION AND CONCLUSION

This chapter reports on the implementation of COCREATE with local trader-farmer groups located in a horticultural production centre in Indonesia. The results of COCREATE implementation are discussed below.

The procedure of COCREATE designed in this study supports active participation of both farmers and local traders. The procedure of COCREATE worked even for participants with marginal education. Facilitators played an important role in this process, supporting farmers and local traders to engage and to apply the paraphrasing technique.

In the design activities, in the separate workshops of farmers and workshops of local traders in Phase A, the procedure facilitated farmers and local traders to learn from their peers to improve their understanding regarding their own situations, and to increase their creativity to generate solutions that could be of use to themselves. These results are in line with (Numa *et al.*, 2008; Yasui *et al.*, 2016). Facilitated by this co-creation approach (applying reflection) different strengths and weaknesses were identified by different farmers and local traders in each group, shared and discussed by farmers and local traders and translated into challenges. Then, based on identified challenges, groups of

farmers and a group of local traders were able to identify possible solutions.

The procedure of design activities in Phase A improved the willingness of farmers and local traders to participate to share their perspectives and experiences regarding their situations. Meanwhile, the implementation of reflection in this process allowed farmers and local traders to learn from their each others' perspectives and experiences. These processes (sharing and reflecting) enriched the understanding of farmers and local traders on their own challenges. This understanding enables farmers and local traders to identify possible solutions for their challenges.

Meanwhile, in the design activities of Phase B in which local traders and farmers worked together (in each local trader-farmer group), reflection using paraphrasing technique enabled farmers to view challenges from a local trader's perspective, and vice versa. Based on these challenges, farmers and local traders identified shared challenges related to quality management of their chain systems from different perspectives (due to different contexts). Reflection during co-creation workshops contributed to improved understanding between farmers and local traders regarding each other's challenges. This common understanding can be implied from solutions and action plans agreed by farmers and local traders (in each local trader-farmer group). Another important thing in Phase B is the information provided by facilitators to answer specific knowledge questions asked by farmers and local traders, as input to the design sessions.

Moreover, the procedure of design activities in Phase B that focussed on common understanding through reflection worked to ease the issue of power relations between the actors involved. This approach enabled farmers and local traders to be more aware of the importance of working together, whilst respecting a division of roles and responsibilities between them.

With respect to the implementation activities, local trader-farmer groups pursued solutions and action plans agreed in the design activities. Even though, not all solutions and action plans were successfully implemented, the relation and task division between farmers and local traders has changed. Local traders in the two groups (Group 1 and 2) in which they participated have become more aware of the farmers' situations and farmers have become more aware of the challenges with which local traders are faced. Shifting the responsibility for post-harvest activities from the local trader to the farmers (that had never been done before in this area) for produce supplied to supermarkets, required a major leap in faith from both parties, but it worked. Availability and transparency of market information from the supermarkets (price, volume order, post-harvest cost) increased awareness for both farmers and local traders, and provided the basis for discussions on daily practice: the choice of crops, desired quality, production techniques and possible governmental support. Shifting these tasks and responsibilities to the farmers was a direct consequence of the COCREATE approach, confirming the importance of awareness of value chain management for sustainable chains (Hernandez *et al.*, 2015; Unnevehr, 2015).

Meanwhile, the group who were left by the local trader (Group 3) struggled to implement solutions agreed in the design activities. However, in follow-up design, they managed to reorganise their group (to be independent of the local trader) and to join an established group.

The need for additional technical knowledge, (Gebrehiwot, 2015; Benson and Jafry,

2013) was also confirmed. All groups in this study discovered the need to form formal farmer groups to access technical knowledge from agricultural extension programmes and to access financial (governmental) programmes (e.g. production inputs subsidies, credit with low interest rate). The self-directed learning approach embraced within COCREATE, made it possible for extension officers to provide information when needed.

In sum, COCREATE has the potential to engage farmers and local traders (connected vertically in the chain) to develop a participatory system to improve their own situations. COCREATE has shown to empower participants to work together over time, supported by facilitators and agricultural extension officers (when needed), in a self-directed learning approach, to improve their own and each others' positions in the chain. This result confirms the importance of space for local actors to: 1) learn from their own experience; 2) learn from each other's experience/perspective and influence each other's perspectives (through reflection) to pursue common understanding to find appropriate ways (through working together) to move forward (Mazigo, 2017; Alemu *et al.*, 2018), and, 3) to organise themselves take actions to enable the changes. With respect to the effect, COCREATE has shown to improve the vertical relation and task division between farmers and local traders with respect to market, information transparency, and institutions.

7

COCREATE IMPLEMENTATION WITH AGRICULTURAL CHAIN ACTORS CONNECTED HORIZONTALLY: PURSUING SUSTAINABLE INCLUSION IN A GROUP OF FARMER GROUPS THROUGH SELF-ORGANISATION

COCREATE has been successfully implemented to empower local trader-farmer groups to improve their vertical relationship (discussed in Chapter 6). Farmers, traditionally excluded from market activities, have engaged in improving their market position together with the local traders. Meanwhile, the local traders have engaged in supporting farmers in the production aspect.

This chapter focuses on the implementation of COCREATE with agricultural chain actors connected horizontally, more specifically with a group of farmer groups (GFG) in Indonesia. This chapter answers the fourth research question: "Can COCREATE be implemented to improve the horizontal relation of agricultural chain actors in Indonesia?", and "What are the effects of the implementation of COCREATE on the situation of the cases with respect to horizontal relations in agricultural production and supply chains?".

This chapter is based on Kusnandar, K., van Kooten, O., & Brazier, F. M. (2020). Sustainable inclusion in farmer organisations as a result of self-organisation: A case study in Indonesia. *Manuscript to be submitted for publication*

As explained in Chapter 5, FOs in Indonesia face many challenges encompassing the absence of clear common goals, the lack of commitment of farmer members, unequal profit distribution, risk aversion of farmers and lack of programmes to empower them. In this thesis, COCREATE is implemented with a group of farmer groups to empower farmer members to understand each other to reach common goals (as a group), and to support them to self-organise their governance to deal with encountered challenges. This group of farmer groups consists of smaller farmer groups located in the same area some of which are formal farmer groups. However, the status of the group of farmer groups is informal.

Section 7.1 discusses the COCREATE implementation for a case study with a group of farmer groups in Indonesia. Section 7.2 provides the results of COCREATE implementation with the group of farmer groups, followed by a discussion and conclusion in Section 7.3.

7.1. METHOD

A group of farmer groups, located in the sub-district of Pangalengan, Bandung District, West Java, one of the horticultural production centres in Indonesia, is the case of this study. Farmer members cultivate various kinds of horticultural crops, for examples beans (various types), white radish, tomato (various types), cabbage, carrots, potatoes, chillies.

7.1.1. SETTING

The group of farmer groups (GFG) of Pangalengan was initiated by a formal farmer group located in Pangalengan sub-district. This formal farmer group obtained a programme in market access from a local university. As a result, in 2015, they acquired access to a supermarket. This farmer group's access to the market grew significantly. As they could not fulfil the market demand themselves, they involved other farmer groups in the neighbourhood to join them to supply produce to these supermarkets. The informal GFG of Pangalengan was formed consisting of a number of sub-groups of farmers some of which themselves are formal farmer groups.

When COCREATE was implemented (in 2017-2018) the GFG of Pangalengan supplied produce to 4 supermarkets, and they had 13 sub-groups with approximately 100 farmers involved. Each sub-group has its own coordinator whom is a member of the GFG management team (GFG Management).

Contracts with supermarkets are managed by the initiator of the collaboration, the FG of Pangalengan. The GFG Management is responsible for coordination of production, post-harvest activities, quality evaluation, finance and market access and development.

Quality evaluation (e.g. % of Grade A, B, C) is the basis for the payment to farmer members. With respect to price, there is a price agreement between the GFG and farmer members based on the contract price with supermarkets. Farmers receive payment after the GFG has received payment from the supermarkets, most often within 3-4 weeks. With respect to financial arrangements, some sub-groups that have formal legality (formal farmer groups) have acquired governmental programmes for tools and machines. There is sharing in using tools and machines between farmer groups coordinated by the

GFG. They also have access to governmental agricultural extension programmes.

7.1.2. COCREATE FOR SELF-ORGANISATION

The COCREATE approach, discussed in Chapter 4, has been implemented to support self-organisation in the GFG of Pangalengan. Reflection based on the paraphrase technique is essential to this case study.

As in the implementation with cases of farmers and local traders, the implementation of COCREATE with the GFG of Pangalengan consisted of design activities, implementation activities, and follow-up design.

The design activities consisted of 3 workshops between June and July, 2017, in Pangalengan. Participants of these workshops are the representatives of sub-groups and the GFG Management. These meetings were organised to: 1) improve the understanding of participants on the challenges encountered by their GFG (i.e. the initial situations); and, 2) co-create solutions to improve their governance to deal with the challenges (i.e. the first desired situation). These workshops were supported by 2 facilitators and a researcher from TU-Delft.

After the design activities, there was a period in which the GFG (the sub-groups and the GFG Management) implemented solutions agreed in the design activities (i.e. the transition period). The transition period lasted between July 2017 and April 2018, after which the follow-up design commenced.

The follow-up design consisted of 2 workshops conducted between April-May 2018, in Pangalengan. Participants of these workshops are the representatives of sub-groups and the GFG Management. These workshops were organised to: 1) share understanding of the implementation of agreed solutions and the changes in the situation during the transition period (i.e. the transition situations); and 2) improve solutions based on the experience in the transition period (i.e. the second desired situations). These workshops were supported by 2 facilitators and a researcher from TU-Delft.

The number of participants in the co-creation workshops is shown in Table 7.1

Table 7.1: Number of participants in the design activities and follow-up design

		Number of farmers
Design activities (June-July 2017)	Workshop 1	13
	Workshop 2	12
	Workshop 3*	15
Follow up design (April-May 2018)	Workshop 1	15
	Workshop 2	18

*) An extension workshop due to the time constraint in the Workshop 2

7.2. RESULTS

This section discusses the implementation of COCREATE by the GFG of Pangalengan (supported by facilitators) to self-organise their governance (during the period of research between 2017-2018) to deal with their challenges. The discussion is divided into:

1) challenges faced by the GFG of Pangalengan; 2) the initial and first desired situations (Section 7.2.1); and 3) the transition and second desired situation (Section 7.2.2).

7.2.1. CHALLENGES FACED BY THE GFG OF PANGALENGAN

From the first workshop of design activities, participants indicated that the GFG of Pangalengean faced the challenges of: 1) commitment of farmer members to the GFG; 2) internal information flow; 3) bottlenecks in the production and supply chain; and 4) financial arrangements.

With respect to commitment of farmer members to the GFG, farmer members often do not supply the agreed quantity and quality of produce to the GFG (through their sub-groups) needed to fulfil the contracts, especially when the price in the traditional markets is higher. This situation has become worse as market demand increases (as market access increases). With respect to information flow, as the number of sub-groups increases and the geographical distance between members increases, the information flow no longer suffices. With respect to bottlenecks in the chain, the GFG faces a labour shortage for post-harvest activities and quality monitoring and grading [1] as market demand increases. Meanwhile, with respect to financial arrangements, farmer members of the GFG (who are smallholder farmers) require financial support in cash and production inputs (e.g. seeds, fertilisers, pesticides), while neither the GFG nor the sub-groups are in the position to provide such types of support.

7.2.2. THE INITIAL AND FIRST DESIRED SITUATIONS

The discussion of the initial and first desired situations of the GFG of Pangalengan is divided based on the four challenges with which they were faced (i.e. commitment of farmer members, information flow, bottlenecks in the production and supply chain, and financial arrangements).

GOVERNANCE TO DEAL WITH THE CHALLENGE OF COMMITMENT OF FARMER MEMBERS

The challenge of the commitment of farmer members is related to the agreement of supplying produce through the GFG to fulfil market contracts. With respect to market contracts, the GFG, represented by a sub-group (the GFG initiator), had formal (written) contracts with supermarkets encompassing product, price, quality, quantity, and supply schedule.

In the initial situation, the responsibility of managing produce to fulfil the market contracts was centralised at the GFG. Meanwhile, farmers (in every sub-groups) were responsible for supplying produce (in bulk) through the GFG with informal (verbal) agreements between farmer members (through their sub-groups) and the GFG. These agreements are based on the contracts with markets, for example, the GFG implemented the price based on produce quality, with a price agreement in advance (contract price adjusted to markets).

To deal with the challenge of the commitment of farmer members (to supply produce through the GFG), in the design activities, the GFG decided to have sub-groups

[1] The GFG hired and trained people from neighbourhood to do post-harvest activities and quality monitoring and grading activities.

perform monitoring on farming activities of farmer members (to increase produce quality [2] and to supply produce based on agreement). Also, there will be a change in the system of produce supply such that farmer members (through sub-groups) are to supply packaged/graded produce, instead of produce in bulk (related to the challenge of the bottleneck in the chain).

GOVERNANCE TO DEAL WITH THE CHALLENGE OF INFORMATION FLOW

With respect to the challenge of information flow, related to the distribution of market, supply plans and produce quality (as the basis of payment) information. In the initial situation, with respect to the market and supply plan information, the GFG Management had meetings with the coordinator of sub-groups on market contracts, to discuss produce supply plans (that have been made by the GFG Management) to fulfil the market contracts. Then, based on these plans, the coordinators were responsible for making planting crop schedules for their sub-groups and to distribute them to their farmer members.

In the design activities, participants agreed to improve communication between the coordinators of sub-groups and the GFG Management, both through face to face (regular meetings) and online communication (WhatsApp group) [3]. Meanwhile, to improve information distribution to farmer members, every sub-group agreed to organise regular meetings, both to share information from the GFG Management and to gather information from farmer members. These regular meetings will also be used as a medium to determine planting crop schedules through discussions between farmer members and their coordinators.

GOVERNANCE TO DEAL WITH THE CHALLENGE OF BOTTLENECKS IN THE CHAIN

The challenge of bottlenecks in the chain is related to internal production and supply chain activities. In the initial situation, the GFG Management was responsible for post-harvest activities and quality monitoring and grading [4] (e.g. % of grade A, B, C), informing farmer members through their coordinators of the results as the basis for payment. In addition, the GFG Management also coordinated the internal supply of seeds [5]. Farmer members (in every sub-groups) were responsible for production (planting, maintaining and harvesting crops).

As mentioned before, there were bottlenecks in the post-harvest and produce quality evaluation due to labour shortage. In the design activities, participants agreed to distribute these activities to the sub-groups. Therefore, the sub-groups will supply graded/packaged produce to the GFG (to be supplied to supermarkets). With respect to labour, farmers in every sub-groups will participate in post-harvest activities and produce quality monitoring and grading (with an incentive scheme). An additional benefit of this approach is

[2] the GFG of pangalengan, supported by Unpad, extension programmes, developed and disseminated standard procedure for farming to improve produce quality of farmer members

[3] WhatsApp

[4] The GFG hired and trained people from neighbourhood to do post-harvest activities and quality monitoring and grading activities

[5] Some seeds (e.g. tomato, potato, beans, carrot) are provided by the GFG to support farmer members (with a credit scheme), and there are farmer members who have specialized in producing these seeds

increased transparency of produce quality information for farmers. The GFG Management agrees to help sub-groups to train their farmer members together with experienced coordinators and some farmer members.

GOVERNANCE TO DEAL WITH THE CHALLENGE OF FINANCIAL ARRANGEMENTS

With respect to financial arrangements, some of the sub-groups that are formal farmer groups have acquired in-kind financial support from governmental programmes, limited to agricultural machines and tools. Farmer members, however, require financial support in cash and/or in kind (i.e. production inputs).

In the design activities, participants agreed to formalise their GFG through pursuing the establishment of a farmer cooperative to enable them to access formal funding institutions as an appropriate legal entity. Each sub-group agreed to contribute to fulfil the requirement of seed capital [6].

The initial and first desired situations of the GFG of Pangalengan are shown in Table 7.2.

The initial situation of the GFG of Pangalengan with respect to governance with external parties is provided in the Figure 7.1

[6] Based on the government rules, to establish a cooperative, such amount of money is required to be used as seed capital

Table 7.2: The initial and first desired situations of the GFG of Pangalengan with respect to governance

Initial situation		First desired situation	
Centralised	Decentralised	Centralised	Decentralised
Market contracts (to deal with the challenge of commitment of farmer members)			
- Formalising market contracts (represented by a sub-group) - Managing produce supply to fulfil market contracts	- Supplying produce (in bulk) through the GFG	- Formalising market contracts (represented by a sub-group) - Managing produce supply to fulfil market contracts	- Supplying graded/packaged produce through the GFG - Monitoring farmers
The plan of produce supply (to deal with the challenge of information flow)			
- Decision making on produce supply plans, planting crop and seed supply schedules at sub-group level - Meetings between the GFG Management and the coordinators	- Information distribution by the coordinators - Planting crop schedules at farmer level by the coordinators (based on centralised plan)	- Face to face meetings and online communications between the GFG Management and the coordinators - Decision making on produce supply plans, planting crop and seed supply schedules at sub-group level	- Sub-group meetings to share information (e.g. market, production, financial arrangements) and to decide planting crop schedules at farmer level (based on centralised plan)
Internal supply chain (to deal with the challenge of bottleneck in the chain)			
- Supplying seeds - Post-harvest and produce quality evaluation	- Produce quality information distribution - Planting, maintaining and harvesting crops	- Supplying seeds	- Planting, maintaining and harvesting crops - Post-harvest and produce quality evaluation - Produce quality information distribution
Financial support (to deal with the challenge of financial arrangements)			
- Coordination in sharing of the use of tools and machines.	- Access to government programmes	- Coordination in sharing of the use of tools and machines - Establishing a cooperative.	- Contributing to seed capital of cooperative - Access to government programmes

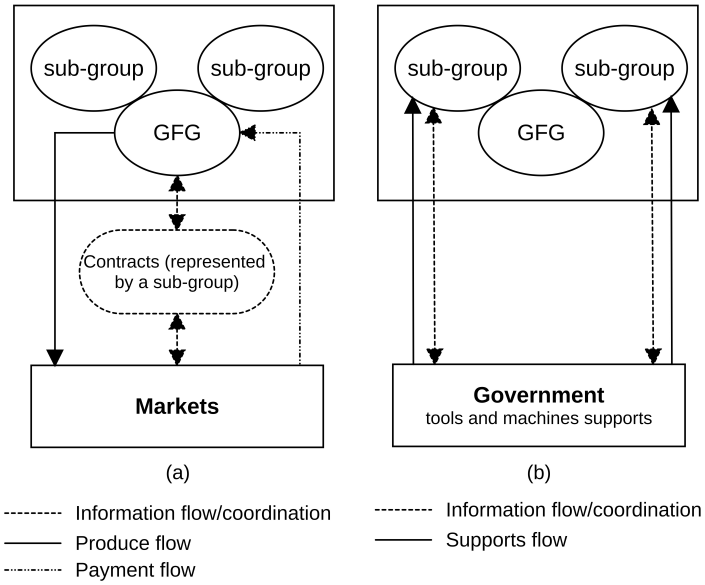

Figure 7.1: The initial situation of the GFG of Pangalengan with respect to governance with external parties: (a) with the market; (b) with the government

Figure 7.2 illustrates the initial situation of the GFG of Pangalengan with respect to internal governance encompassing supply agreement, the produce supply plan, internal supply chain activities, and financial supports (tools, machines, seeds).

7

7.2.3. THE TRANSITION AND SECOND DESIRED SITUATIONS

The transition and second desired situations of the GFG of Pangalengan is also presented based on the four challenges with which they are faced.

GOVERNANCE TO DEAL WITH THE CHALLENGE OF COMMITMENT OF FARMER MEMBERS

In the transition situation, sub-groups were struggling to monitor farming activities of farmers, especially with respect to the implementation of a standard procedure for farming. The result was low quality produce. This situation became worse because the GFG only accepted grades of produce required by supermarkets, while marketing the rest became the responsibility of the sub-groups themselves. This led to many farmer members (in every sub-group) selling all of their produce to traditional local traders again because of the less strict quality requirement, and the payment is much faster compared to supermarkets [7]. In addition, a couple of sub-groups acquired direct access to supermarkets and exporters by themselves. This situation resulted in new conflicts in the GFG of Pangalengan.

In the follow-up design, to deal with this situation, participants agreed to change the role of the GFG, especially with respect to the market. In this new governance, the sub-groups are to become be responsible for managing the produce supply to fulfil acquired

[7] The payment from traditional local traders takes 2-3 days, while from supermarket take 3-4 weeks

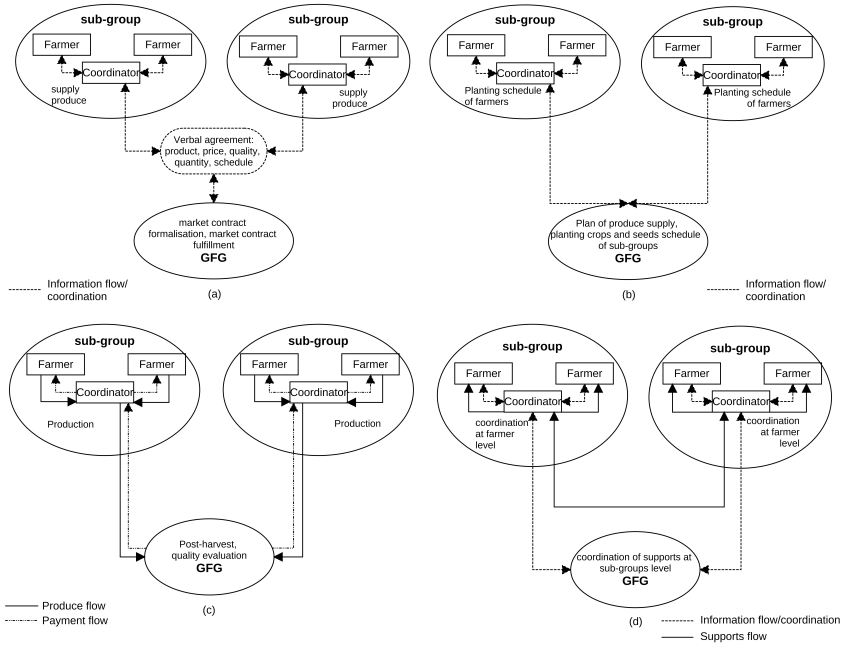

Figure 7.2: The initial situation of the GFG of Pangalengan with respect to internal governance: (a) supply agreement; (b) produce supply plan; (c) internal supply chain; (d) financial support

market contracts. The shift of this responsibility is followed by the shift in incentives. To support the sub-groups, the GFG will coordinate sub-groups in fulfilling market contracts (related to the governance to deal with the challenge of information flow). In addition, the GFG can take a role in coordinating contract formalisation represented by sub-groups, especially sub-groups who have formal legality.

GOVERNANCE TO DEAL WITH THE CHALLENGE OF INFORMATION FLOW

In the transition situation, the GFG tried to improve their internal communication, for example, by creating a WhatsApp group consisting of GFG Management and the coordinator of sub-groups. Meanwhile, at the sub-group level, a couple of sub-groups have started to have meetings among themselves. However, because of the situation in market governance (explained in 4.2.1), most of these activities did not continue.

In the follow-up design, related to the decentralisation of market responsibility, sub-groups agreed to become responsible for decision making on plans to fulfil market contracts. In this new governance, sub-groups are responsible for making the produce supply plans, planting schedules, and production input plans [8]. Meanwhile, the GFG will take a role as an information hub for sub-groups, for example, to coordinate sub-groups in case of produce shortage in certain sub-groups, while there is oversupply in other sub-groups.

[8] In the desired situation, the GFG have plans to provide production inputs support (e.g. seeds produced externally, fertilisers, pesticides)

GOVERNANCE TO DEAL WITH THE CHALLENGE OF BOTTLENECKS IN THE CHAIN

In the transition situation, a couple of sub-groups started to do post-harvest activities and quality monitoring and grading by themselves. Meanwhile, the rest are still struggling to do this.

During the follow-up design, participants agreed to continue the plans agreed in the design activities. This decision is also related to the plan to decentralise the market responsibility.

GOVERNANCE TO DEAL WITH THE CHALLENGE OF FINANCIAL ARRANGEMENTS

In the transition situation, with respect to the plan of establishing a cooperative for more financial support, the GFG was struggling to collect contributions from the sub-groups to fulfil the requirement of seed capital. The internal conflict mentioned above also made it more difficult for the GFG to pursue the plan of establishing a cooperative. Despite this situation, one sub-group acquired access to funding on their own through collaboration with an investor.

During the follow-up design, participants agreed to hold on to the plan of establishing a cooperative. To acquire financial support, the sub-groups will look for investors with whom to collaborate in profit-sharing systems (inspired by the previous successful sub-group), instead of trying to access funds from formal funding institutions. In addition, the formal sub-groups will maintain access to governmental programmes. Meanwhile, the GFG will have functions in information sharing with respect to potential investors and supporting the sub-groups to formalise such cooperation (with investors).

The transition and second desired situations of the GFG of Pangalengan with respect to governance to deal with their challenges is shown in Table 7.3

The second desired situation of the GFG of Pangalengan with respect to the governance with external actors is depicted in the Figure 7.3

Table 7.3: The transition and second desired situations of the GFG of Pangalengan with respect to governance

Transition situation		Second desired situation	
Centralised	Decentralised	Centralised	Decentralised
Market contracts			
- Formalising market contracts (represented by a sub-group) - Managing produce supply to fulfil market contracts	- Supply graded/packaged produce through the GFG (not all) - Monitoring farmers (still struggling)	- Formalising market contracts (represented by appropriate sub-groups) - - Coordinating sub-groups to fulfil market contracts.	- Supplying produce through the sub-groups - Managing produce supply (to fulfil appointed market contracts) - Monitoring farmers
The plan of produce supply			
- Meetings between GFG Management and the coordinators (face to face and online) - Decision making on produce supply plans, planting crop and seed supply schedules at sub-group level	- Sub-group meetings to share information and to decide planting crop schedules at farmer level (not regular)	- Information hub (face-to-face and online)	- Sub-group meetings to share information and to determine produce supply plans, planting crop and production inputs schedules
Internal supply chain			
- Supplying seeds - Post-harvest activities (not all) - Produce quality evaluation (not all)	- Planting, maintaining and harvesting crops - Post-harvest and produce quality evaluation (a couple of sub-groups) - Produce quality information distribution	- Supplying production inputs	- Planting, maintaining and harvesting crops. - Supplying produce to sub-groups (all sub-groups) - Post-harvest and produce quality evaluation activities (all sub-groups) - Produce quality information distribution (all sub-groups)
Financial supports			
- Establishing cooperative (struggling)	- Collecting seed capital for cooperative establishment (struggling) - Access to investor (one sub-group) - Access to government programmes	- Information sharing with respect to potential investors - supporting formal cooperation	- Access to investors (more sub-groups) - Access to government programmes

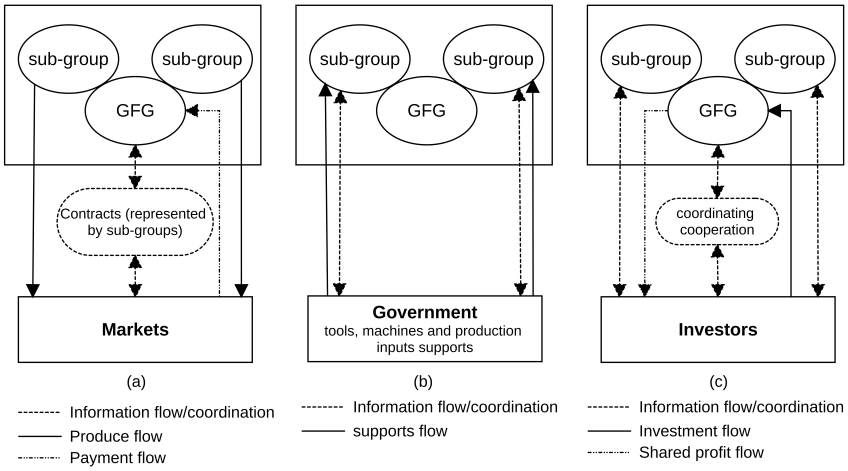

Figure 7.3: The desired situation of the GFG of Pangalengan with respect to the governance with external actors: (a) with the market; (b) with the government; (c) with investors

The second desired situation of the GFG of Pangalengan with respect to internal governance encompassing supply agreement, the plan of produce supply, internal production supply chain, and investment from investors are depicted in the Figure 7.4. Internal governance of support from the government and production inputs are still the same.

7

7.3. DISCUSSION AND CONCLUSION

This chapter explores the potential of COCREATE to support self-organisation in a case study in an exemplary group of farmer groups in Indonesia, i.e. the GFG of Pangalengan. Supported by facilitators, following the procedure discussed in Chapter 4, multiple COCREATE sessions were performed over time by the GFG of Pangalengan.

The results show that, through COCREATE, the GFG of Pangalengan was able to self-organise their governance, in particular in the production and supply chain, to deal with their challenges. The COCREATE empowered the GFG of Pangalengan to improve understanding of their situations and challenges and to find solutions (by themselves) to reorganise their governance.

The results also show that the self-organisation in the GFG of Pangalengan is an evolving process. Challenges identified in the initial situations evolved during the transition period as a result of the implementation of solutions (agreed in the first round of co-creation meetings). Then, based on this experience, the solutions were evaluated and adapted to deal with evolved challenges.

In this self-organisation process, the commitment of farmer members of the GFG of Pangalengan was sustained through participation in the multiple sessions of COCREATE. Hence, the GFG of Pangalengan was able to maintain the inclusion of farmer members (Apparao *et al.*, 2019).

Meanwhile, with respect to the form of governance, the GFG of Pangalengan decided to move from centralised to decentralised governance. In this new form of governance,

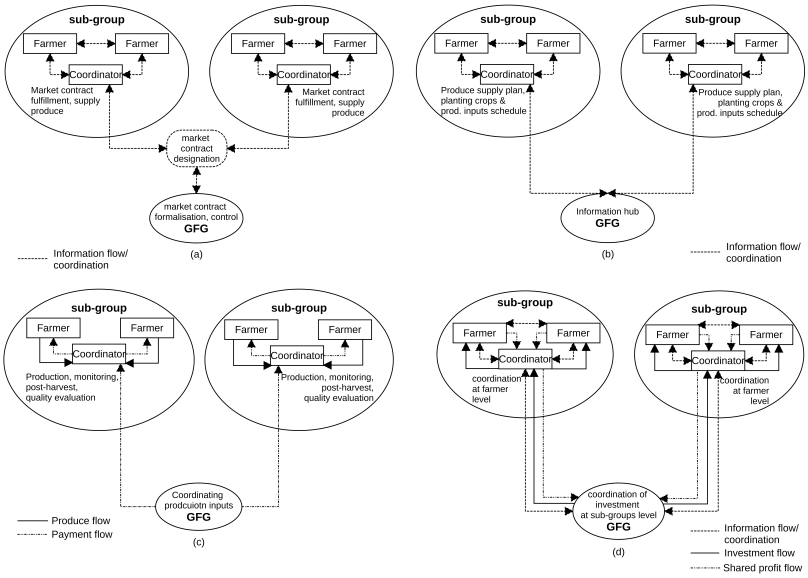

Figure 7.4: The desired situation of the GFG of Pangalengan with respect to internal governance: (a) supply agreement; (b) the plan of produce supply; (c) internal supply chain; (d) investments from investors

most GFG responsibilities with respect to market, supply plans, internal supply chain activities, and financial supports were moved to the sub-groups. The GFG new roles include information coordination and supporting contract formalisation. The GFG believes that decentralised governance can help them deal with their challenges (commitment of farmer members, information flow, bottlenecks in the chain, financial arrangements) because it facilitates more farmer members to participate in the activities of the GFG. This is in line with previous works on production and supply chain governance, e.g., (Klaas-Wissing and Albers, 2010; Lee and Billington, 1993; Lintukangas *et al.*, 2009).

In sum, three findings are shown in this study: 1) through COCREATE, self-organisation in FOs in developing countries is possible; 2) self-organisation leads to sustainable inclusion due to the increase in participation; and 3) decentralised governance is a promising solution for FOs to deal with challenges, such as commitment of farmer members, information flow, bottleneck in the chain, and financial arrangements. However, the process of reorganising governance is a long-term process and requires new forms of evolving support for self-organisation in FOs in developing countries.

8

DISCUSSION, CONCLUSION AND FUTURE WORK

The importance of participation for sustainable agricultural production and supply chain (APSC) has been implicitly stated in the UN's SDG 2.4 and 2.C. For this, empowering agricultural chain actors, especially in developing countries, is needed. APSCs in developing countries are characterised by the large number of smallholder farmers who do not recognize opportunities to change their own situations due to the lack of knowledge, information, and capital. This thesis proposes an approach to empower agricultural chain actors in Indonesia to self-organise themselves to pursue sustainable APSCs.

Participatory Action Research, supported by Research through Design was performed consisted of: 1) a literature review on basic concepts related to the research; 2) the design of a framework for participatory sustainable agricultural development (PSAD) used to analyse previous programmes on sustainable agricultural development (SAD), 3) lessons learned from previous programmes of sustainable agricultural development; 4) the design of a co-creation approach to empowerment (by taking into account the results of point 1, 2 and 3; and, 4) implementing this cocreation approach over time in case studies of horticultural production and supply chains in Indonesia. The results from every step are analysed to answer the research questions.

Section 8.1 addresses the research questions based on the results of this research, followed by a discussion and conclusion (Section 8.2) and future work (Section 8.3).

8.1. RESEARCH QUESTIONS REVISITED

The main question to be addressed in this research is: "Can agricultural chain actors (connected vertically and horizontally) in Indonesia be empowered to pursue sustainable agricultural production and supply chains?".

This question is addressed by answering the following research questions:

1. **Which factors contribute to the participation of agricultural chain actors to pursue sustainable agricultural production and supply chains in developing countries?**

To answer this question, in Chapter 3, a framework for participatory sustainable agricultural development (factors of environmental, economic, social, and governance) is proposed, on the basis of which sustainable agricultural development programmes (SAD) in developing countries reported in the literature are analysed. The framework of PSAD focuses on the principles of participation on which most previous frameworks do not focus.

This thesis shows that most programmes on SAD in developing countries followed the top-down approach focusing on improving economic factors and enforcing formal institutions (governance) to improve environmental factors. Most of these programmes have limited effect due to: 1) conflicts of interest between actors in the chain; 2) incompatibility of technology with local situations; 3) lack of translation of theoretical knowledge into practice; and, 4) lack of transparency of new institutions.

This thesis also shows that although most programmes deployed a top-down approach focusing on economic factors and existing formal institutions, several programmes have broadened this focus to include social factors of engagement and empowerment, in addition to economic, governance, and environment. In these programmes local actors were given space to participate in situation analysis and designing solutions. In fact, several programmes supported local actors (in continuous follow-up programmes) to take actions and take responsibilities for their own action. These programmes, that focus on horizontal relations in the chain, have had positive effects on pursual of SAD. Increasing actor participation in pursuing sustainable APSCs, by considering social factors of engagement and empowerment, in addition to economic, governance, and environment is the approach this thesis embraces.

2. **Can an approach to empower agricultural chain actors be designed?**

To address the challenges faced by most previous top-down programmes on SAD, Chapter 4 proposes the COCREATE approach. This approach focuses on social factors of empowerment and engagement while still embracing economic, governance and environmental factors. While the significant roles of project initiators characterise previous approaches of pursuing sustainable APSCs, the COCREATE empowers local actors to engage in designing solutions to be implemented by local actors themselves (through working together) to deal with their situations. For this, pursuing a common understanding of involved actors on their common situations is essential in COCREATE. With respect to involved actors, while previous approaches focus on horizontal relationships, COCREATE involves multiple actors connected not only horizontally but also vertically in the APSCs in which power imbalance exists.

COCREATE is designed to: 1) facilitate actors to learn from their own experience and others' experience/perspectives to improve common understanding on their chain situations; 2) facilitate actors to find appropriate ways (by themselves) to deal with their situations; and 3) support actors to take actions to enable changes in their APSCs. With respect to its structure, COCREATE consists of design and implementation activities, and the process of these activities is cyclic with continuous feedback. Reflection through use of a paraphrasing technique is essential to COCREATE. To ensure that the procedure of COCREATE (including paraphrase technique) is applied appropriately, actors are supported by facilitators.

3. **Can the designed empowerment approach be implemented to improve vertical relation of agricultural chain actors in Indonesia? With which effects?**

   Chapter 6 provides the results of the COCREATE implementation (consists of design, implementation, and follow-up design activities) in a case study with local trader-farmer groups in a horticultural production area in Indonesia, supported by facilitators.

   In the design activities farmers and local traders were able to apply the COCREATE approach, including the paraphrasing technique to improve their awareness of both their own and others' situations. They identified common challenges and co-created solutions.

   In the implementation activities, farmers and local traders worked together in their own groups to implement the agreed solutions. This resulted in changes in their production and supply chains including changes in: 1) the relations between actors and task division; 2) their market position; 3) information transparency; and, 4) the governance of the groups.

   In the follow-up design activities, farmers and local traders co-created follow-up plans in their own groups to adapt to the changes in the situation (e.g. market, institutions) and to find new solutions for those that that are less effective (e.g. in dealing with pests and diseases).

4. **Can the designed empowerment approach be implemented to improve horizontal relation of agricultural chain actors in Indonesia? With which effects?**

   Chapter 7 provides the results of the COCREATE implementation in a case study with a group of farmer groups (GFG) in Indonesia that faced challenges of commitment of farmer members, information flow, bottlenecks in the chain, and financial arrangements.

   As in the cases of farmers and local traders (Chapter 6), members of the GFG (represented by the GFG Management and coordinator of sub-groups) were able to apply the COCREATE approach including the paraphrasing technique to acquire a common understanding of their own situation, to identify challenges, possible solutions and actions to improve their situation. The GFG was able to self-organise their governance to deal with the encountered challenges.

   This thesis also found that self-organisation, in this case, is an evolving process, and that the commitment of farmer members of the GFG is shown. It resulted in the ability of the GFG to maintain inclusion.

8.2. DISCUSSION AND CONCLUSION

This thesis has shown that COCREATE can be effectively deployed to empower agricultural chain actors in Indonesia to learn over time, to adapt to the changes, and to self-organise. COCREATE focuses on the engagement of involved actors to participate and to work together to enable sustainable change. COCREATE embraces knowledge in markets, logistics, financial and institutions, in addition to knowledge in production by involving market chain actors (local traders) and supporting actors (agricultural extension

agents and a local university). The main effect of COCREATE is common understanding improvement of actors (through paraphrasing and reflection) on their own situations and that of others, as the basis to find appropriate ways to move forward, not only as individual actors but also as actors in an APSC.

COCREATE has shown to be a promising approach that can be used to empower agricultural chain actors in Indonesia and other developing countries to pursue sustainable APSCs. However, implementing COCREATE requires a different type of support than most previous top-down programmes for sustainable APSC. In this approach, the programme's initiators (e.g. government, NGOs, universities, agricultural extension agents) should take a role as facilitators to support agricultural chain actors in self-directed learning activities in addition to providing specific courses and support for specific topics and issues.

With respect to support, COCREATE requires intense support from facilitators both in design and implementation activities. The support encompasses: 1) encouraging involved actors to engage and to apply the procedure of COCREATE, including the paraphrasing technique; 2) acquiring information to answer specific knowledge questions asked by participants, facilitating access to external parties when needed, and 3) supporting and facilitating self-directed learning activities. However, if COCREATE is implemented over time with farmers and other chain actors, less intense support should be needed from facilitators. Empowering agricultural chain actors to pursue sustainable APSC is a long-term process that enables actors to learn and to adapt to the changes over time. As a consequence, a different type of investment is needed to implement COCREATE over time (in long term programmes) to support actors in this process.

Agricultural extension programmes (that have been established in Indonesia and other developing countries) can be extended to enable long term programmes of COCREATE implementation (discussed in more detail in Section 8.3). As the resources of agricultural extension programmes in Indonesia and other developing countries is limited, cooperation with local universities can be a promising strategy. Training for extension officers and others (people from local universities) is required to ensure COCREATE procedure is implemented appropriately.

Another challenge of implementing COCREATE is scalability. COCREATE requires intensive support in its initial phase, and sustained support thereafter. A phased approach is needed in which different types of support may be organised. Technology may be able to support farmers learning activities through online information exchange and discussions (discussed in more detail in Section 8.3). Considering the case of farmer groups (Chapter 7) that have already used social media such as WhatsApp to share information, this solution would be feasible. However, based on the results of this research (Chapters 6 and 7) and considering previous cases of e-extension programmes in developing countries that have shown to have limited effect e.g. (Kelly *et al.*, 2017; Munthali *et al.*, 2018), physical interaction is still critical. Therefore, online interactions should be combined with the physical interactions.

8.3. FUTURE WORK

COCREATE that was designed and implemented in this thesis has shown the promising effect of enabling self-organisation for sustainable change in APSC. However, this thesis

has limitations including: 1) the choice of actors in the chain; 2) the period of empowerment; and, 3) cases of implementation (explained in more detail below).

Based on these limitation and insights gained during this research, future work will focus on:

1. **Involving more than two tiers of agricultural chains actors in COCREATE implementation**

   With respect to the main actors of APSC, this thesis only involves two tiers: farmers and local traders. However, results show that regulation (e.g. payment period, order mechanism, order volume) implemented by other market players, are the cause of some of the challenges faced by both farmers and local traders.

   Future research will focus on the potential of COCREATE to the involvement of other market players (e.g. supermarkets, exporters), in addition to farmers and local traders to improve the coordination in APSC.

2. **Translating COCREATE into long-term programmes**

   As explained in Section 8.2, a long-term period is needed to empower agricultural chain actors through COCREATE, and agricultural extension programmes could be extended to implement COCREATE through cooperation with other institutions, e.g. local universities. However, the structure of COCREATE designed and implemented in this research is project-based, and not programme based.

   Further study, therefore, is needed to include the COCREATE structure into long-term programmes, e.g. agricultural extension programmes, local universities programmes, with a regular schedule of activities to support agricultural chain actors in self-directed learning to explore the potential of different types of facilitation (perhaps by farmers themselves).

3. **Technology for COCREATE**

   As explained in Section 8.2, technology may provide a solution to increase the scalability of COCREATE implementation, i.e. through online communication. However, considering the many small actors with marginal education involved in the APSC in Indonesia and other developing countries, the technology should be designed to be appropriate for them to participate.

   With respect to this, further study is needed to: 1) find appropriate mechanisms for online communication (including information sharing and discussion) that can support engagement of farmers and other actors in the chains; 2) design a platform that can support the essential elements of COCREATE, especially to facilitate the reflection; and, 3) design a procedure to combine the online and physical interactions to be effective to support involved actors in self-directed learning activities.

4. **Implementing COCREATE in multiple APSCs systems**

   The cases explored in this thesis are limited to APSCs located in a specific horticultural production centre in Indonesia. Even though there are similarities (e.g. involved actors, chain structure, power relation), different locations will have a different local context.

With respect to this, further study is needed to understand the effects of COCREATE implementation in other APSCs located in multiple locations in Indonesia and other developing countries to enrich the findings of this research.

APPENDICES

Appendix 1. Matrix of cases of programme and the variables of sustainable agricultural development framework

No	Case	Environmental			Economic					Social			Governance		Effect
		1.1	1.2	1.3	2.1	2.2	2.3	2.4	2.5	3.1	3.2	3.3	4.1	4.2	
1	Marine Steward Council (MSC) Label for fish in South Africa. (Ponte, 2008)	0	2	0	0	0	0	0	0	0	0	0	2	0	0
2	Private incentive mechanism to improve tuna sustainability in Philippines: Fishery Improvement project FIF. (Tolentino-Zondervan *et al.*, 2016)	0	2	0	2	0	0	0	2	0	0	0	2	0	0
3	Private incentive mechanism to improve tuna sustainability in Philippines: Marine Steward Council (MSC). (Tolentino-Zondervan *et al.*, 2016)	0	2	0	0	2	2	0	2	0	0	0	2	0	0
4	Private incentive mechanism to improve tuna sustainability in Philippines: International Seafood Sustainability Foundation (ISSF). (Tolentino-Zondervan *et al.*, 2016)	0	2	0	0	0	0	2	2	0	0	0	2	0	0
5	Conservation agriculture (CA) promotion at Cabo Delgado, Mozambique. (Lalani *et al.*, 2016)	2	0	0	0	0	0	0	2	0	0	0	0	0	NA
6	Marine protected areas (MPA) in India. (Ramesh and Rai, 2017)	2	2	0	0	0	0	0	0	0	0	0	2	0	0
7	Farmers field school (FFS) in China. (Guo *et al.*, 2015)	2	0	0	0	0	0	0	2	0	1	2	0	2	0
8	Participatory land use planning in Laos. (Bourgoin *et al.*, 2012)	2	0	0	0	0	0	0	0	0	1	2	0	2	NA
9	Auction for payment for ecosystem services in Indonesia. (Leimona and Carrasco, 2017)	2	0	0	0	0	0	2	0	0	0	0	2	0	1
10	Testing resilience thinking in the context of poverty in Nigeria. (Bene *et al.*, 2011)	2	0	0	2	0	0	2	0	0	1	2	0	2	NA
11	Developing fisheries co-management in the Tam Giang Lagoon system in Vietnam. (Ho *et al.*, 2016)	2	2	0	2	0	0	2	2	0	0	0	2	0	0
12	Sloping land conversion programs in China. (Kelly and Huo, 2013)	2	0	0	0	0	0	0	2	0	0	0	2	0	0

(Continued)

Appendix 1 (continued)

No	Case	Environmental			Economic					Social			Governance		Effect
		1.1	1.2	1.3	2.1	2.2	2.3	2.4	2.5	3.1	3.2	3.3	4.1	4.2	
13	Sustainable highland agriculture in Kelang Village, Yunan Province, China. (Subedi *et al.*, 2009)	2	0	0	2	0	0	0	2	0	0	0	0	0	0
14	The equitable payment for watershed services in Morogoro, Tanzania. (Branca *et al.*, 2011; Kwayu *et al.*, 2014)	2	0	0	2	0	0	2	2	0	0	0	2	0	1
15	International payment for marine ecosystem in Mauritania. (Binet *et al.*, 2013)	0	0	0	0	0	0	2	0	0	0	0	2	0	0
16	Managing fish Pirarucu quota at Mamiraua, Brazil. (Castello *et al.*, 2009)	0	2	0	0	0	0	0	2	0	1	2	2	0	2
17	Fishers alliance in Philippines. (Anabieza *et al.*, 2010)	0	2	0	2	0	0	0	2	0	0	2	2	0	2
18	Volunteer farmer trainers for dairy farmers in Kenya. (Kiptot and Franzel, 2014)	2	0	0	2	0	0	0	2	0	1	2	0	2	1
19	Biogas technology dissemination in sub-Saharan Africa. (Parawira, 2009)	2	0	0	2	0	0	0	0	0	0	0	0	0	0
20	Improving dairy production in Cameroon. (Bayemi and Webb, 2009)	2	0	0	2	0	0	0	2	0	0	0	0	0	1
21	Forest conservation by private sector in Malawi. (Chinangwa *et al.*, 2017)	2	0	0	2	0	0	0	2	0	0	0	2	0	NA
22	Conservation policies in Rajiv Gandhi National Park, India. (Nautiyal and Nidamanuri, 2012)	2	2	0	0	0	0	0	0	0	0	0	2	0	0
23	Biogas installment and organic fertilizer production at craft village in Mekong-Delta, Vietnam. (Le *et al.*, 2016)	2	0	0	2	0	0	0	0	0	0	0	0	0	NA
24	Volunteers farmer trainers to promote safety and health at work for farmers in Vietnam. (Kawakami *et al.*, 2008)	2	0	0	2	0	0	0	2	0	0	0	0	2	1
25	Agricultural water fee collection in China. (Wang and Chen, 2014)	2	0	0	0	0	0	0	0	0	0	0	2	0	0
26	Contract farming between an exporter and paprika farmers in Malawi. (Repar *et al.*, 2017)	0	0	2	2	2	0	0	2	0	0	0	2	0	2

(Continued)

Appendix 1 (continued)

No	Case	Environmental			Economic					Social			Governance		Effect
		1.1	1.2	1.3	2.1	2.2	2.3	2.4	2.5	3.1	3.2	3.3	4.1	4.2	
27	Participatory business incubation of poultry in South Africa. (Alderson and Jordaan, 2007)	0	0	0	2	0	0	2	2	0	1	2	2	0	1
28	Conservation agriculture in Chongwe District, Zambia. (Mfune, 2013)	2	0	0	0	0	0	0	2	0	0	0	0	0	0
29	Empowering women farmers through farmers research group in Ethiopia. (Oumer *et al.*, 2014)	0	0	0	2	0	0	0	2	0	2	2	0	2	2
30	Bioethanol development in Brazil. (Franco *et al.*, 2010)	2	0	0	2	0	0	0	0	0	0	0	2	0	0
31	Bioethanol development in Mozambique. (Franco *et al.*, 2010)	2	0	0	2	0	0	0	0	0	0	0	2	0	0
32	Organic product development for Chepang tribal people at Chitwan district, Nepal. (Haas *et al.*, 2016)	0	0	2	2	2	2	0	2	0	0	0	0	0	1
33	Improving safety and quality of produce for supermarket in Honduras. (Bloom, 2015)	0	0	2	2	2	0	0	2	0	0	0	0	0	NA
34	Ecological based rodent pest management. (Palis *et al.*, 2011)	2	2	0	2	0	0	0	2	0	0	0	0	0	1
35	Forest product certification in Indonesia. (McCarthy, 2012)	2	2	0	0	0	0	0	0	0	0	0	2	0	0
36	Roundtable sustainable on palm oil (RSPO) certification in Indonesia. (McCarthy, 2012)	2	2	0	0	0	0	0	2	0	0	0	2	0	0
37	Payment for environmental services in Protected Areas in Cambodia. (Clements and Milner Gulland, 2015)	2	2	0	0	0	0	2	0	0	0	0	2	0	0
38	Policy of Government of Peru to protect Lake Titica. (Vera Cartas *et al.*, 2013)	2	2	0	0	0	0	0	2	0	0	0	2	0	NA
39	Organic cotton cultivation at Meatu district in Tanzania. (Altenbuchner *et al.*, 2016)	2	0	0	2	2	0	2	2	0	0	0	2	0	2
40	Collaborative resources management at Kibale National Park, Uganda. (Solomon *et al.*, 2012)	2	2	0	2	0	0	0	0	0	0	2	2	0	2

(Continued)

Appendix 1 (continued)

No	Case	Environmental			Economic					Social			Governance		Effect
		1.1	1.2	1.3	2.1	2.2	2.3	2.4	2.5	3.1	3.2	3.3	4.1	4.2	
41	Farmers-to-farmers training on Integrated Pest Management (IPM) in La Paz county, Bolivia. (Jors *et al.*, 2016)	2	0	2	0	0	0	0	2	0	1	2	0	2	2
42	Agricultural extension reformation in Bangladesh. (Islam *et al.*, 2011)	0	0	0	0	0	0	2	2	0	0	2	0	2	0
43	The impact of Marine National Parks on food security of local people in Kenya. (Darling, 2014)	2	2	0	0	0	0	0	0	0	0	0	2	0	0
44	Management of highland wetlands in Kenya. (Macharia *et al.*, 2010)	2	2	0	0	0	0	0	0	0	1	2	0	0	NA
45	Payment for ecosystem services in Northern Tanzania. (Nelson *et al.*, 2010)	2	2	0	0	0	0	2	0	0	0	0	2	0	2
46	Grassland management program in northern China. (Kemp *et al.*, 2013)	2	0	0	2	2	0	0	2	0	0	0	0	0	1
47	Fodder shrub innovation adoption in East Africa. (Wambugu *et al.*, 2011)	2	0	0	2	0	0	0	2	0	0	0	0	0	0
48	Sustainable highland agriculture in Yunnan Province China. (Subedi *et al.*, 2009)	2	0	0	2	0	0	0	2	0	0	0	0	0	1
49	Farmer field school to promote Integrated production and pest management (IPPM) in West Africa. (Settle and Garba, 2011a)	2	0	2	0	0	0	0	2	0	1	2	0	2	1

Notes

Header: (1.1) Water, land, and air; (1.2) Biodiversity; (1.3) Food safety; (2.1) Production; (2.2) Market; (2.3) Logistics, transportation and communication infrastructures; (2.4) Financial infrastructures; (2.5) Capacity development; (3.1) Trust; (3.2) Empowerment; (3.3) Engagement; (4.1) Formal institutions; (4.2) Informal institutions

Value of factors:(2) factors exist; (1) factor exist but limited; (0) factor does not exist

Effect: (2) long-term effect; (1) short-term effect; (1) little/limited effect; (NA) unknown

Appendix 2. Interview Protocol

Information sheet
You are being invited to participate as a respondent for an interview in a research study titled ***[Empowering Horticultural Supply Chain Actors in Indonesia]***. This study is being done by ***[K. Kusnandar]***, a PhD candidate from the Systems Engineering Sections, Department of Multi-Actor Systems, Faculty of Technology Policy and Management, TU Delft, Netherlands. This study is his PhD research project.
The purpose of this interview is ***[to obtain information about general situations of agricultural production and supply chain in Indonesia]***, and will take you approximately ***[60]*** minutes to complete. The interview will be recorded (an audio-recorded interview), and [the transcript] will be made. The data will be used as ***[materials for writing PhD thesis and academic publications]***.
Your participation in this study is entirely voluntary and you can withdraw at any time. You are free to omit any question.
We believe there are no known risks associated with this research study; however, as with any online related activity the risk of a breach is always possible. To the best of our ability your answers in this study will remain confidential. We will minimize any risks by ***[keeping the personal information of the respondent confidential]***.

Questions:

1. Could you describe the current supply chain structure (actors, networks), from farm to market, for agricultural products, especially for horticultural products, in Indonesia?
2. Based on that structure, could you describe the relationships/chain governance/dependencies between these actors?
3. Could you describe challenges in Indonesian agricultural production and supply chains, especially for horticultural products (e.g. in production, market, logistics, finance, governance)?
4. Could you describe the types of (formal and informal) farmer organisations in Indonesia, especially in horticultural sector? Could you explain the differences between them (e.g. in their governance, role in agricultural production and supply chains, possibilities/restrictions)? Challenges with which they are faced?
5. Could you describe challenges for farmer organisations in Indonesia to develop and be sustainable? Do you know of any (e.g. governmental) programmes/attempts now/in the past designed to tackle these challenges?
6. Could you describe the role/importance of extension programmes in Indonesia with respect to sustainable development?
7. Could you describe if and how food safety is currently addressed by the different stakeholders in the production/supply chain for horticultural products in Indonesia (related to the activities from farm to market)?

Appendix 3. The summary of the results of interviews

Respondent 1	Respondent 2	Respondent 3	Respondent 4
Supply chain structure			
- Farmers - local traders - Distributors: traditional, modern market players, AgriTech companies, industries-Consumers (majority) - Farmer organisations - Distributors - Markets (minority) - Farmer organisations - AgriTech companies - Markets (minority)	- Farmers - local traders - Markets(majority) - Farmers - Markets (minority) - Farmers - AgriTech companies - Markets (minority) - Farmers - Auction markets (minority) - Farmer organisations - Modern market players - Markets (minority) - Farmer organisations - Company - markets (minority)	- Farmers - local traders - Markets:traditional and modern (majority) - Farmers - Markets (minority) - Farmer organisations - industries (minority)	- Farmers - local traders - Markets (majority) - Farmer organisations - AgriTech companies - Markets (customers, supermarkets, export, industries) (minority)
The governance between farmers and local traders			
- The local traders provide credits, then farmer supply their produce to the local traders - Social relationships	- The local traders provide credits, then farmer supply their produce to the local traders - Farmers sell crops before harvesting periods	The local traders provide credits, then farmer supply their produce to the local traders	The local traders provide credits, then farmer supply their produce to the local traders
The governance between local traders and traditional markets			
Selling and buying ungraded products		Selling and buying ungraded products	
The governance between local traders and modern markets			
Contract in supply of graded products		Contract in supply of products: quality, quantity per period, product specification	
The governance between farmer organisations and modern market players			
- Contracts in supply of graded products, and the buyers provide credit - Contracts in supply of graded products	- Contract in supply of products, and the buyers provide seeds and technical assistances - Contracts in supply of graded products	Contract in supply of products	

(Continued)

Appendix 3 (continued)

Respondent 1	Respondent 2	Respondent 3	Respondent 4
The governance between farmer organisations and AgriTech companies			
Contracts in supply of products, and the buyers provide credit and technical assistances			Contracts in supply of graded or ungraded products, and the buyers provide credit and technical assistances
Challenges in horticultural supply chains			
- The mismatch between production and markets: most production systems has no production plan, planting, harvesting and supply schedule - Lack of financial infrastructures for farmers - The availability of seeds (most of them are imported) - Lack of cold chain systems causing high food losses and waste - The policy from government less focus on horticultural sector	- Lack of farmer organisations - Lack of quality assurance - Lack of continuity of supply - Lack of cold chain systems - Credit from government is not absorbed optimally	- The long supply chain systems causing high cost - No invective-alignment, especially in the farmer-local trader chains: unequal margin distribution, lack of information sharing	- Low productivity - Lack of cold chain systems - A lot of markets do not concern on produce quality - Misunderstanding of customer preferences on good quality products
Types of farmer organisations			
- Farmer group (beginner, middle-class, advanced) - Village farmer group association - Sub-district farmer group association - Cooperative	- Farmer group - Village farmer group association - Sub-district farmer group association - Cooperative	- Informal farmer group - Formal farmer group - Cooperative	- Farmer group - Village farmer group association - Sub-district farmer group association
The challenges of farmer organisations			
- The absence of clear common goals between members - The programmes from government only focus on forming farmer groups not on empowering farmers	- Lack of commitment of farmer members - Farmer members lack entrepreneurial spirit - The domination of the head of farmer groups	- Farmer members, mostly old farmers, reluctance to take risks to innovative	- The absence of clear common goals between members - The number of formal farmer groups are still small
The role/importance of agricultural extension programmes			

(Continued)

Appendix 3 (continued)

Respondent 1	Respondent 2	Respondent 3	Respondent 4
- Insufficient number of government agricultural extension officers - Lack of trust from farmers to the government agricultural extension officers - The extension programmes less focus on markets - There are AgriTech companies providing farmers with extension programmes - The absence of education programmes for customers	- Insufficient number of government agricultural extension officers - Extra works for the officers: the officers are also assigned to facilitate government programmes in agriculture and administrative works	- The programmes are not structured and not integrated - Top-down programmes, not based on farmers' needs - Lack of trust from farmers to the government agricultural extension officers	- Top-down programmes, not based on farmers' needs - Lack of trust from farmers to the government agricultural extension officers - The extension programmes from AgriTech companies are more integrated from production, market and administration - The extension programmes from AgriTech companies are conducted through field experiments - Weekly monitoring in the extension programmes from AgriTech companies
The condition of food safety in the horticultural supply chains			
- There is IndoGAP, but it is not connected to markets, so most farmers do not implement it - Most exporters have followed the food safety standard based on the requirements from their markets - Traditional markets less concerns on food safety	- There is IndoGAP, but most farmers do not implement it - The absence of value for certified products - Most exporters have followed the food safety standard based on the requirements from their markets - There is the development of organic products and the system of organic certifications	- Most actors do not implement food safety standards - Most exporters have followed the food safety standard based on the requirements from their markets - There is the development of organic products and the system of organic certifications	- Most farmers do not implement food safety standards - There is the development of organic products for export markets - It should be the value to implement food safety standard - It needs technical assistances for farmer to implement food safety standards

Appendix 4. The transcript of interviews with the respondents

Notes:
I : Interviewer
R : Respondent

The translation of transcription of interview with a people from Directorate General of Horticulture, Indonesian Ministry of Agriculture

I	Thank you very much for your willingness to be a respondent for this interview. This interview has a purpose to obtain information about general situation of horticultural production and supply chain in Indonesia. It is a part my PhD project. Your participation in this interview is voluntary, so if you mind to answer specific questions, you may not to answer them. This interview will be recorded, audio recording. With respect to research ethics, the access to the recording will be limited to the researchers in this project. In addition, your personal information will be kept confidentially. Is everything already clear?
R	Yes yes.
I	Ok, let's start with the first question. Could you please to explain about the structure of horticultural supply chains in Indonesia, including who actors are, from production to market, and what the networks look like?
R	Form the actors, for supply chains, it is started from farmers. Actually, there are many supply chains in horticulture in Indonesia. It can be from farmers go directly to market, there are also from farmers through the local traders. There are many systems between farmers and local traders. There is a system called "ijon". There are also farmers who sell products. Ijon is when farmers sell their crops before harvesting period with low price. It is because they have no money, they have planted the crops, for examples until 2 months, then they have no money then they sell the crop to the local traders. The next activities of farming including harvesting are taken by the local traders, but farmers have received the money. There are also farmer groups, but farmer institution in Indonesia is still weak. Actually, there are good farmer groups. So, farmers join farmer groups, then join the joined farmer groups, then join a corporation. It is the highest level of farmer groups, the best. Farmers in this corporation has been coordinated to sell their products through the corporation. This corporation has been had a partnership with a private company.
I	Could you explain about the corporation, what is it?
R	It is a cooperative. I can give you a good example that is in Lampung (Sumatera). So, they have had partnership with a big company called A. So, the A not only buy products from farmers from the cooperative, but also give technical assistances especially in farming practices. The A also supply seeds to farmers. It is because their market is not only domestic but also export markets, so the varieties of product have to suit the market demand. It is the highest level of agricultural supply chains.
I	Are there a lot of cases like this in Indonesia?
R	No, only this one. Actually, there were many programmes from the Ministry of Agriculture to bridge farmer groups to markets, but they are not sustainable. It is because the lack of commitment of farmers, for example, first they want to join the program, but then after some time they sell again their product to local traders because of the higher price. So, there is less commitment of farmers. But, there are not only the commitment of farmers, but also the commitment of partner. So, the private companies, for example first they agreed with the initial agreement, such as about the grade of products, then after some time they change it. Therefore, the farmers are disappointed about that. I think it is the challenge.
I	Yes, we will talk about the challenges later. You mentioned that there are farmers who sell their products directly to farmers, could you explain the characteristics of these farmers?

(Continued)

(continued)

R Usually, farmers who have capital, farmers who have knowledge and capital. If they are smallholder farmers who only have land with small size, they usually don't do it. It is because farmer who have access to markets, they are usually aware what market needs, and also the risk for these farmers are low. So, they take the risk to sell their product directly to market.

I Let's talk about the chain of farmers who sell products through local traders. Which markets usually local traders sell their products?

R Mostly to traditional markets.
There are also farmers who have partnerships with start-up companies, e-commerce companies. There is an increase in this kind of company in Indonesia. Even though most of them are in Jakarta, maybe only in Java.
There is also for export, mangosteen, it is in Bali. It comes from a farmer group who has a partnership with an exporter. But it is different with the cooperative I explained before. This exporter only buy products, they don't involve in production.

I Is there anything else you want to explain about the supply structure?

R Let's continue, if remember something else, I'll tell you.

I Ok, let's move on to the relationship between actors and the governance, the relationship between farmers and local traders, local traders and their markets, as you explained the relationship between the cooperative and the company.

R The relationship between farmers and local traders is the capital relationship. They don't have money, they ask for a loan to the local traders, then their products will be sold to the local traders. That is like informal contract. It is because the lack of capital owned by farmers.

R Oh yah, I just remember about supply chain structured, there is a development of auction market for chilies in Sleman (Central Java). In this market, farmers from anywhere can supply their chillies. So, every night there is an auction market, after "Isya" (around 7 pm). Farmers are pleased to supply, then the buyers from anywhere can involve in the auction. It is organised by the farmer association in that area. The good thing from this is the competitive price.
However, the problem is many farmers do not want to join. Even though farmer groups have persuaded them to be involved, but most of them rejected it, because they prefer to sell their chillies to the local traders. Maybe, it is because the payment from the local traders is faster and, maybe, because the close relationship between them.

I Do you know about the supermarket chains?

R Yes, in Cianjur District (West Java), for vegetables, for this I just give an example, there is a farmer group who has a partnership with a supplier to supply not only to retail but also to hotel, restaurant, café, horeca. Maybe there are individual farmers, but I still don't know. It is usually a contract to have a continuous supply, if there is a farmer group, it can be organised, harvesting schedule, so it can be continuous.

I Now, could you explain, in general, what are the challenges faced by horticulutal production and supply chains in Indonesia?

R One has been mentioned, the commitment.
There was a case, the cooperation with Korean for pineapple. It cannot continue because there was no continuous supply. I think it is because the lack of commitment of farmers. Mostly is like that. Meanwhile, the continuous supply is very important for modern markets, for export markets.
And also, the institutions is not good. As I said, if there is an offer from the local trader that is easier, they prefer the local trader.

I What about the production aspect?

R The production, I think the quality. The quality assurance is still not good. It is not like in Japan or Europe, they have Global GAP. We have IndonGAP, but it is only a registration system for farm land. For production, our quality assurance is still not good. But, for export, it must be the high quality products. For the quality, the problem is also the disparity. There are good products, there are also bad products, so it not uniform.
Also continuity, it is because of the season, except for the crops that can be planted anytime, such as banana, pineapple. Mangosteen doesn't continue due to the season.

I What about the market aspect, what are the challenges for market?

(Continued)

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R For export, usually, ministry of agriculture, every year, always try to open market access. Last year, for example, we open the market to China, next to other countries. next year we will find market access for pineapple. So, we always have international meeting, so there is always a plan for international markets. As I know last year is for the dragonfruit, the next is for fresh pineapple.

I From logistics, is there any challenges?

R The challenge is the cold chain, it is because the horticulture product is vulnerable. It should use cooler, but they don't use it.
Infrastructure is also not good to support the quality assurance of products.

I Ok that is the logistics, what about the finance?

R Actually, last year, we have launched the program of credit for farmers. For the loan below IDR 50 million, it doesn't need the collateral. But, in the implementation, our bank partners, appointed by the government, they make the procedure become more difficult. There are still many problems in the implementation. Even though we have target of the amount of the credit accessed by farmers, but it is not reached. Maybe, it is because a lot of farmers don't have access to this information. But, there is an effort from the government to give the capital to farmers.

I Ok, from the aspect of governance, it can be government policies or the governance between actors in the chains, is there any challenges?

R Actually, if all farmers join farmer groups, their institutions will be strong, then they will have better bargaining position. However, most farmers don't want to join, they don't care. Actually, if the institutions is improved, then they make partnerships with retail or other markets, they could have good bargaining position. But, unfortunately, up to now, the farmer institutions are still weak.

I So, the main challenge is the farmer institutions.

R Yes, that is the main challenge.
Also, farmers don't have Entrepreneurial spirit. It should be, if they want to sell the products, they have to know the markets, what markets need, what quality, what variety. But, our farmers don't do that, most farmers are not like that. Farmers who do that, maybe, farmers with big capital. Therefore, the quality planning has not existed yet. So, smallholder farmers have not been like that.

I Relate to the farmers institutions, now we are talking about the farmer group. Could you describe the type of farmer group in Indonesia, and what the differences between them?

R Farmer groups, as I know, the formal farmer groups are registered in "simluhtan" (systems of agricultural extension programmes). Farmer groups form the joined farmer groups, then the joined farmer groups form associations.
One village usually consists of a number of farmer groups, the joined farmer group is in the level of village.

I Actually, what are the function of the form of joined farmer group and association?

R Joined-farmer group will have more farmer member, so, as I mentioned, to organise the products. So, if there is a partnership with a private company, it must need continuous supply, so there will be more farmers participate.

I Still talking about farmer group, it has been explained, there are many cases of the partnership between farmer groups and private companies don't continue. Could you explain what the challenges of farmer group to developed and to be sustainable?

R That is what I have said, they are not cohesive, there are some farmer who tried to maintain the farmer group, but there are also farmers who prefer working with the local traders. So, they don't have the same voice. There are many temptations that broke their commitment. Meanwhile, there should be commitment to be together.

I You have mentioned there are many programmes from Ministry of Agriculture to develop farmer groups and to bridge them to markets. Is there anything else that you want to add?

R The programmes of market access are always conducted every year, we always help the farmers. Usually, from countries with tight requirements, we always help to get the access. Usually, they (international markets) come here to verify farmers, then we help the farmers to prepare everything they need for it.

I Ok, now we continue with the topic of agricultural extension programmes. Could you describe the role of extension programmes in horticultural production and supply chains in Indonesia?

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R	Their roles are very important, especially to disseminate the information, technology in farming. Farmers are still not good in agricultural technology. However, the number of extension officers is still limited. As I know, it usually in sub-district level. One officer can handle one village, even, can be more than one village. So, it is the lack of number. Meanwhile, technical assistances to farmers are very important, not only in production but also in institutions. Usually, if extension programmes also strengthen the institutions, it is usually better. But, there is still the lack of the number of extension officers. In addition, the extension officers are functioned to facilitate the programmes from the government, because they know the real situation of farmers. So, they have extra works. In fact, sometime they are asked to help the local government, so it decreases their time in the field. So, actually their function is very important to transfer the information from central government to farmers, but there is the lack of number of the officers.
I	So, the number of officers is not sufficient, and also there are extra works for them
R	Yes, that what I understood.
I	Is there anything else you want to add?
R	I think that's all.
I	Let's move on to the topic of food safety. Could you describe for current situation, how actors in horticultural supply chains in Indonesia address the food safety?
R	Actually, in the farm land registration, there is also food safety aspect. For certification, there is also food safety aspect. But, it has not been implemented by all farmers. Maybe the dissemination of this programme is still needed. So, from production, post-harvest still does not exist yet. I mean, it is not like in Europe, the farmers are big farmers who have certification. In here, most farmers are smallholder farmers who have small farm land. For farm land registration, I think, the effort is too much. Also, market certification has not existed yet. So, the certification has not been value added for us. We should conduct a promotion to consumers to inform the certified products that have high quality, and to encourage them to buy the products with high price due to the quality. It is like what Thailand and other countries did. However, the certificate has not been value added for our customers, so it is not a priority of farmers. Except for export, it is usually based on market requirements, for example markets need GlobalGAP, or organic. For organic, there is a value added, and there are markets for organic products in Indonesia,
I	How is the development of organic product in Indonesia?
R	As I understood it has developed. The certification system has established, and there are organic certification institutions in Indonesia. And also, the price is good.
I	Is the organic certification institution under the government?
R	No, there are many LSOs (organic certification institutions), such as B.
I	Is there anything else you want to add?
R	Actually, there are many programmes from Ministry of Agriculture to build the quality, but Indonesia is big countries with various conditions. So, it is not easy to build horticultural in Indonesia. The good thoughts are needed. There are many challenges. Maybe in the future we need the sustainable programmes.
I	Ok, thank you very much for your time and information. If I still need some information, do you mind if I contact you again?
R	Sure. Just contact me if there is any other information needed.

The translation of transcription of interview with an Associate Professor from Padjadjaran University (Unpad)

I	Thank you very much for your willingness to be a respondent in my research project. This interview has a purpose to get information about general situation of agricultural production and supply chain in Indonesia, especially for horticultural products. It is my PhD research project. In this interview, your participation is voluntary. If you mind to answer certain question, you can refuse to answer them. This interview will be recorded, voice recording, and the access to the voice recording will be limited to only the researchers of this project. Also, your personal information will be kept confidentially.

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I Let's start with the first question, could you please to describe the supply chain structure of horticultural products in Indonesia, from farmers to market, including who the actors are, and what their networks look like?

R Ok, thank you for choosing me as a respondent.
So, the structure of horticultural supply chains in Indonesia, in general, there are farmers, intermediary traders or local traders, distributors, consumers. Distributors can also go to supermarkets, or from distributors can also go to inter islands traders, from distributors can also go to hotels restaurants and cafés (HORECA), and sometime to industries. The distributors are located in markets, traditional markets.
local traders are located in the production centers. They are traders not agents, because there is a transaction process between farmers and them. There are many local terms for local traders: tengkulak, pedagang pengumpul, bandar, etc. Every region has their own term.
So, in general, Indonesian supply chains for horticulture products are dominated by that structure. But, there are also cases that from farmers directly to distributors not through local traders. These distributors are usually distributors who supply most products to supermarkets, in addition to traditional markets.

I Do you mean supermarket suppliers?

R Yes, they are supplier supermarkets, but they are located in the production centers.

I So, the distributors can be divided into distributors of traditional markets...

R Yes, there are distributors located in traditional markets, there are distributors supplying products to supermarkets. But, there are also distributors in traditional markets supply produce to supermarkets. Therefore, in the big cities, supermarket build their distribution centers close to traditional markets.

I What about export markets?

R There are exporters who buy produce from distributors, they also buy produce from local traders. There are also exporters who buy products from farmers directly. They are exporters who have contracts with farmers and make planting schedule to ensure continuous supply.
There are also exporters who buy products from distributors in traditional markets.

I Currently, there is a trend of online market, or e-commerce, for agricultural products in Indonesia, what about this market?

R The proportion of this market is still low. But, due to this pandemic, there is an increase, before the pandemic the proportion is only about 5%, now it is about 10-15%. The function of this market is to shorter the supply chain. But, some of them buy produce from the local traders, or there are also the companies who buy produce from distributors in traditional markets.

I In the supply chain structure, in which category is the e-commerce company?

R In my opinion they are in the category of distributor who use technology in their business. But, there are the companies who buy produce from distributors in traditional markets, for examples in Jakarta. But there are also e-commerce companies who build partnerships with farmers.

I Is there any data for the proportion of horticultural products that go to traditional markets, supermarkets, export markets, and other markets?

R There is no research about that since the research of World Bank in 2006-2007. Based on that research the proportion of products sold to modern markets is 30%, and the rest goes to traditional markets. I think there is no significant difference with today situation.

I Let's moving on to the topic of governance, could you describe the relation between farmers, local traders, distributor and the governance between them in the horticulture supply chains in Indonesia?

R Mostly, the relation is transactional, only selling and buying. But, today, there is a development, because of the need of markets, especially structured markets, such as supermarkets, export markets, including e-commerce, then they build partnerships with groups of producers, groups of farmers, or, it can be called contract farming. They usually give farmers credit in kind of production inputs, but there are also distributors who don't give credit, just market the products. These are usually distributors who supply products to structured markets, such as supermarkets or export markets, for examples in horticulture C Farm, D, and other companies. They have started to build partnerships with farmers. There are also food companies who do the same thing.

I What about the relation between farmers and local traders?

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R First, it is only transactional relationships, but then it changed. Because the local traders need continuous supply of products, including to supply to supermarkets and export markets, then farmers become regularly selling to the same local traders, then there is a need of farmer to get a loan from the local trader. Therefore, from business relationship turns to social relationship due to the loan. Farmers can ask the loan to the local traders anytime. It is because there is no financial infrastructure for farmers. Meanwhile, getting a loan from the local trader can be very fast and easy, because farmers have guarantee to supply their products to the local traders. In addition, they already know each other. The loan can be for farming also for other needs, such as cost of education of farmers children. Therefore, the social ties between them become much stronger.

I About the distributors that you mentioned, supermarket suppliers, exporters, who have the partnerships with farmers, did they build partnerships directly with farmers?

R Mostly through local traders, but there are also the cases of partnerships with farmers directly.

I What about the governance of traditional markets?

R There is no partnership with traditional markets. They buy products "abresan" (all grades with one price). They buy products from anyone, from anywhere.

I Now, let's talk about the challenges, could you please to describe the challenges faced by Indonesian agricultural production and supply chains, in particular for horticultural products, for example form the aspect of production, market, logistics, finance, governance?

R The first and the most important challenge is the mismatch between market and production. So, the market should change first, they have to build the continuity of supply with stable price and food safety and etc. I call it the structured market, then they have to build the structured production systems. Currently, most production systems are not structured. Therefore, the production systems do not connect to the market. There is no production planning. Farmers plant crops based on the size of their land, then look at the plants grown by other farmers in their neighbourhood, then they choose crop to be planted, plant it, harvest and sell it. There is no planting schedule.

So, when there are structured markets, such as supermarkets, export markets, industries, HORECA, the main problem is how farmers are able to change their production systems to be more industrialise. It means to be structured with production planning, planting schedule, seed schedule, harvest schedule, and delivery schedule. It is not easy for farmers, especially for farmers who are above 40 years old. It is very difficult for them. That is the first challenge.

Second, when farmer harvest their crops, they already spent money for their crops, but when they sell their products, the money is not directly received by them, because the delay payment, especially from supermarkets, exporters, industries, HORECA with the reason of administrative procedure. Therefore, it needs the financial infrastructure. It is the challenge of supply chain finance.

For vegetables, the availability of seed is also a challenge because most of seeds are imported. The main point is how to maintain the sustainability of supply. From the aspect of logistics, from pre-harvesting, if markets require Grade A, the production should be designed to produce mostly Grade A product. But it does not happen. Then, harvesting and post-harvest, because of not good infrastructure, there is very high lost. Food losses and waste is about 10%. Cold chain does not exist in the village level. It also contributes to the food losses. For exporter companies, they have not been trained in logistics for agricultural products, for example, cold chain should be in the pre-harvest, harvest, and post-harvest activities, but they do not implement it. For finance, I have mentioned it. Also, the finance still focuses on production. Meanwhile, it should not only in production aspect.

For governance, the policy from government still focuses on staple food crops, such as rice, corn and soybean. For horticulture, the budget is very limited. Even though there are programmes of government in horticulture, but they are limited to onion and chili, because they are considered as strategic commodities. Meanwhile other commodities are neglected.

I Let's move on to the topic of farmer organisation. Could you please to describe the types of farmer organisations in Indonesia, formal and non-formal?

R Based on the government version, there are the beginner farmer group, middle-class farmer groups, and advanced farmer group. Then, between farmer groups can form a joined farmer groups organisation. It usually consists of 4 farmer groups located in the same villages. There are also farmer groups joining cooperative, but it is very rare in horticulture.

I What are the differences between the beginner, middle-class, and advanced farmer group?

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R It is the government version, they are categorised based on the experience of the members in farming, based on the period of the establishment of the groups. They have to be registered in agricultural extension systems (Sisluhan).

I With respect to the governance, is there any differences between these farmer groups?

R Normatively, it should be different, the more advance should be better in managerial, but it is not. The only active if there are aid programmes from the government, mostly like that. But, there are also farmer groups who are active because they are connected to markets.

I You mentioned about the joined farmer groups, what are the functions?

R They are established only to fulfil the requirements from government to get access to government aid programmes, because some programmes are performed through the joined farmer groups.
In addition, they are formed to make it easier for agricultural extension programmes. The base of agricultural extension is sub-district that consists of villages, so to organise farmers they form the joined farmer groups.

I What about the cooperative?

R It is different thing. Cooperative is a legal business entity who owned by the members. Meanwhile, the farmer groups focus on production aspect.

I Still talking about farmer organisation, based on literature there are many farmer organisations formed by the government or NGOs, but most of them are not sustainable. What do you think the main challenges of farmer organisations in Indonesia to develop and be sustainable?

R The first challenge is the motivation of farmer members, it should be the same motive between the members, because there should be the same goals, economic goals, for example to fulfil the market requirements. Most farmer groups in Indonesia have no clear common goal. The motivation to develop together, prosperity, are only normative things. That is the internal challenge.
The external challenge is from the government. The government, form the aspect of empowerment, the designed does not increase the capacity of farmers. There are the division of farmer groups, beginner, middle, advanced, but it is only the division of groups, but they are not designed to increase the capacity of farmers, the design of programmes is not clear. Including other aspect, it should be connected to market, the connection between them. That the biggest challenge.

I So, so far, the government programmes are only to form farmer groups, not to increase the capacity of farmers.

R Yes, it is still sporadic. It should be sustainable, isn't it? And also, the budget form government is very limited.

I We're moving to the topic of agricultural extension programme. You have mentioned it before. Could you please to describe the role of extension programmes in sustainable horticultural production and supply chain in Indonesia?

R Actually, the extension programmes for horticultural products are quite neglected, because the government focuses on staple food crops, rice, corn and soybean. The dynamics are different. Horticultural sector are more dynamics because it is connected to market, etc. the role of extension officers for horticultural products are very limited. First, from the aspect of their capacity, second, form the aspect of the number of the officers. There is only one horticultural extension officer for one sub-district. Therefore, their scope is very limited. That is for the government extension programmes.
However, with this new era of technology, in the future the role of extensions will be included in the farmer organisations and markets. For example, F (an e-commerce company), they have built the ecosystem encompassing market, finance, then they make the technical assistances programmes. That is the function of extension programmes, isn't it? But with different context, because from the aspect of commercialisation, their level is higher than the government extension programmes.

I You mentioned there is only one horticultural extension officer for one sub-district, if you have the idea, how many farmers in one sub-district?

R Actually, I don't know precisely, but if we calculate, one sub-district usually consists of 15 villages, one village consists of 4 farmer groups. Therefore, one sub-district consists of 60 farmer groups. One group usually has 25 farmer members, so it is about 1500 farmers. One officer for 1500 farmers.

I Is there anything else about extension programmes you want to explain?

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R In my opinion, this situation should be addressed through the cluster approach, agrocluster. But it should be connected with markets, it should be market hub that is not only market but also there is an education programmes for consumers and also farmers. So, the voice from consumers are heard directly by farmers.
I mean with cluster is there is an integration, for example in planting schedule, there is an integration among plants, integration between plants and animals. So there is a circular systems, because our farmers are smallholder farmers, not big farmers.

I Ok, let's move on to the last topic that is about food safety. Could you please to describe how every actor in the horticultural supply chain in Indonesia address the food safety?

R Actually, for food safety, horticultural sector is more advanced than staple food sector. In horticulture, there is a government programme of GAP (Good Agricultural Practices), from farm field registrations to certifications. However, it is not connected to market, market actors are not involved. Therefore, when the programmes form government ended, it is done, because there is no market incentive. It is the problem of sustainability. So, we cannot rely on the budget from government. It should be the initiatives from the stakeholders.
Then, at the packing house, there is a certification for warehouse. At consumer level, especially in the big cities, it just started, there is a rapid test for food safety. The big companies, especially exporters, they should have GAP certificate. For big companies, they have started to build packing house, and then fulfilled the food safety through ISO 22000, including cold chain systems, halal, etc.

I Are there a lot of actors who comply the food safety?

R For exporters, yes, they have to. Supermarkets, food processor companies, they have started. For example, F, they have ISO 22000 including HACCP. They use it as a competitive advantage for their company, when most other companies have not fulfilled food safety yet. So, there is also an education for their consumers, and become their competitive advantage.

I What about traditional markets?

R Traditional market has not concerned on food safety. Meanwhile, due to this pandemic, food safety should be one of pillar.

I Is there anything else you want to explain?

R I think that's all.

I Ok thank you very much for your time, information and insights.

The translation of transcription of interview with an Assistant Professor from Bandung Institute of Technology (ITB)

I Thank you very much for your willingness to be a respondent in my research project. This interview has the purpose to obtain the information about general situation of horticultural supply chains in Indonesia. It is a part of my PhD research.
Your participation in this interview is voluntary. Therefore, if you mind to answer certain questions, you may not to answer them. This interview will be recorded, an audio recorded interview. Then, considering the research ethics, the access to the recording will be limited to only researchers in this project.
Is there anything you want to ask?

R I think everything has been clear.

I Ok, so we can start with the first question. Could you describe the supply chain structure of horticultural products in Indonesia? who the actors are, from farmers to markets, and what the networks look like

R Horticulture, I think we have to agree first about the scope of horticultural products.

I Oh, horticultural encompasses vegetables, fruits, flowers and herbal plants. About my research, the focus is on vegetables.

R Ok.
In general, for supply chains of horticultural products in Indonesia, it is in general, it is still dominated... in the upstream it starts from farmers, then there are local traders, there are small local traders, big local traders. Then, after that, the chains can go to traditional markets then to customers. There are also the chains to exporters or supermarkets, but all of the chains are dominated by the local traders.

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I Are there farmers directly sell products to markets?

R I think yes, but there only few farmers, and almost impossible. If they sell products directly to markets, the markets are located very close to their farm lands, not markets located in big cities.
If farmers sell products directly to markets, they not only concern on farming activities but also on markets. For most farmers, it is too much. They can't concern on both farming activities and markets, if they concern on markets, the concentration to farming activities will be not optimal.

I Ok I see
What about farmers join the farmer groups, then they take a role in market?

R Yes, there are farmer groups that also take a role in market. But, in some cases, in these farmer groups, the head of farmer group take a role as the local trader. But he is a part of the farmer group. He is like a double agent, as a farmer and as a local trader, and he has access to markets. The example is farmer groups who supply products to G (a big food companies), the potatoes. The head of farmer group has already had access to Indofood, then he organises farmers located in his area to supply their potatoes to Indofood.

I Ok, so there is a key farmer who become the head of farmer group and functions as local trader.

R Yes, it is because farmers in Indonesia are dominated by small farmers who have no knowledge and information about market.

I Oh ok.
Is there anything else you want to add about the structure of horticultural supply chains?

R Horticultural supply chains. Currently, there are farmer groups that have access to markets, so the chain become shorter. But, what I see, there is still lack of incentive alignment. It is still the head of farmer group, even though he is part of the farmer group, he has a highest proportion of profit compared to other farmers. But, I think it is better, because they have fix demand for farmers, for example the case of Indofood. I think it is better through the farmer groups than through the local traders. It is because, the head of farmer group, he experiences as farmers, so he would threat farmers better.

I Ok.
Now, let's move on to the topic of relationship between actors, farmers, local traders, traditional markets, export, supermarkets, what do their relationships look like?

R The relationship between farmers and local traders, it is actually the transactional relationship. What I need and what you have. They don't talk about long-term relationship. Why farmers have very strong relationship with their local traders, it is because of financing. Farmer need finance, and it is very difficult for farmers to get finance from legal banks. The only actors who can give them finance are the local traders. So why their relationships become strong. In addition, farmers are struggling to organise the finance, they cannot separate money for farming activities and for living.
The local traders, actually, do not connect to only one farmer. But, farmers have lack bargaining power, because they don't have enough information about market, what markets require, what the price. So, they just accept what the local traders offer. It is the relationship between farmers and local traders.
Between local traders and markets, actually they can negotiate, but the price is still determined by the markets. But, the local traders are still actors who have highest margin along supply chains. Meanwhile, the biggest risks are borne by farmers. When farmers have crops failure, the local traders don't help.

I Ok.
For the local traders, what are the differences between selling to traditional markets, supermarkets and export markets?

R Ok. It is related to the certainty of demand and the specific requirements. In traditional markets, it's like, the quality requirements are not specific, what local traders have are accepted by the traditional markets. For export market and supermarkets, they have contract stated specific demand for every period, the quality of products, and also the specific of weight, for example the weigh per tomato. For these requirements, it is very difficult to find farmers who can fulfil them. And also, farmers don't know what supermarkets and exporters require. That is why contract farming is important. When we know what markets require, it can be the basis for determining seeds, scheduling to have continuous supply that suit market demand. In traditional markets, there is no contract like that.

I Ok.
Is there anything else you want to add about the relationships between actors?

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R That what I said, because it is transactional, so there is no information sharing, no knowledge sharing, no capacity development from local traders to farmers. Meanwhile, if they want the long-term relationship, and for the sustainability of the local traders, they are very important because farmers are the main source of product supply. If they know what market require, they should build the capacity of farmers to fulfil the market demand.

I Ok, so because of transactional, there is no effort from the local traders to build the capacity of farmers.

R Yes.

I Ok.
Now let's talk about, I think you have mentioned, about the challenges. maybe you can explain more about challenges in horticultural supply chains in Indonesia. It can be from the aspect of production, market, logistics, finance and governance.

R The main challenge is the long chain of supply. It is still long. In fact, for some products, for example in West Java, the producers of horticulture, producers of rice, etc. When farmer harvest their crops, then they are distributed to Jakarta, but then they are sent back to Bandung (West Java), then they are consumed by consumers in West Java. It happens. You can imagine the logistic cost, it must be high. And off course, the consumers should pay the high transportation cost. Meanwhile, the price from farmers, maybe, very cheap.
So, that is the long chain of supply, and farmers receive low margin share compared to others in the chains, and there is no incentive-alignment, no information sharing.
Also the culture, sometime farmers are considered have lack of commitment, they only care about themselves. Sometime, when the price is high, farmers sell their product to the local trader who offer the high price. Meanwhile, hey have contract, for examples with supermarkets with fix price and demand. Sometime, with many reasons, they betray the contract. Meanwhile, following the local trader systems, there are many uncertainties. But, yah, that is their behaviour. It needs capacity building of farmers.

I Ok. Is there anything else you want to add?

R What else, maybe later when I remember.

I Ok
Let's talk about farmer group. Could you describe the types of farmer groups in Indonesia, and what are the differences between them?

R Farmer groups, there are formal farmer groups, or they are formed based on the commitment of farmer members. The member of this farmer group a, b, c, d, and has their own responsibilities. Usually, the formal farmer groups who have access to supermarkets or exporters.
For informal farmer groups, they don't have any agreement. Farmer can supply products through the farmer groups or not to farmer groups. Mostly, they sell products to traditional markets.
There are also farmer groups based on cooperatives. So, the cooperatives are established first, then they find farmers to be their members. I think the cooperative is similar with the formal farmer group, but they are different in the legal aspect.

I Still talking about farmer group, what challenges faced by farmer groups in Indonesia to develop and be sustainable?

R Regeneration, when they are dominated by old farmers, they are usually resistance to innovate, they don't want to do trial and error again, they don't want to try something new. They just do what they have been doing for a long time. Meanwhile, our farmers really need technology. They are still in doubt to implement the new technology, they prefer manually.

I So, they don't want to take a risk

R Yes, they don't want to take a risk before they see that others are successful in implementing the new method. But, even though they have seen the successful case, sometime, it doesn't guarantee they will change their method... is it true it will be successful with only one trial?...they have to make sure it first. So they are risk averse.
Actually, there are young farmers nowadays. But, these young farmers should improve their capacity and innovation continuously. And also in the commercialisation, it should be developed. So, not only do harvest, but it should be added value given to, so they will earn more. It should be young farmers who do that.
I think that is the most important challenge.

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I	Ok, let's talk about the agricultural extension programmes. could you explain what the role of extension programmes in the horticultural supply chains in Indonesia?
R	Ok, when I talked about capacity of farmers that can still be developed, it means the role of extension programmes is very important. But, the problem is our extension programmes are conducted sporadically, it is not structured and not integrated. For examples, every department (in provincial government or district) has their own programmes. Meanwhile, their objects are the same. If they coordinate with each other, their budget can be integrated, so the extension programmes can be continuous based on what farmers need, it should not be top-down, but bottom-up. It should not be what programme you have, but it should be what farmers need. In addition, the extension programmes, sometime, when I interviewed some farmers. the farmers are sceptical, if they heard about training programmes, workshops, they must think that it will be one-way discussion, and the topics can be the same that farmer have known. It should be how to attract the farmers first. So, the farmers are like objects for the departments without knowing what the next will be. After the programmes ended, they are left.
I	Ok. Is there anything else you want to add?
R	The importance is it should be bottom-up, we have to know what farmers need, then send people who understand the real situations.
I	Ok. It is the last question. it is about food safety. Could you explain, for current condition, how actors in Indonesia address the food safety, from farmers, local traders, markets?
R	I think it is still far away, except as I mentioned for export markets. But, sometime, it is sceptical. I heard the story, for example for organic, organic vegetables, organic fruits. For organic I think it is better. But, I got the story... is it true organic?...sometime farmers told, for the organic you can just buy the packaging, just buy the logo. It is so sad. Food safety is for export, but their value added is high, so they can offer high price to farmers when the farmers can fulfil the product requirements. But, for other chains, I think it is still far away, the price for farmer is also low, so it is very difficult, I think.
I	Ok. Is there anything else you want to explain about food safety?
R	But, for organic it is trending in Indonesia now. There are a lot of organic shops, not only for vegetables, but also for flour, etc' I think that's all.
I	Thank you very much for the information. If I miss some information, can I contact you again.
R	Sure, OK.

The translation of transcription of interview with a people from an AgriTech company

I	Thank you very much for your willingness to be a respondent in this interview. So, this interview has a purpose to obtain general information about horticultural supply chains in Indonesia, and it is a part of my PhD project. Your participation in this interview is voluntary. Therefore, if there are certain questions you mind to answer, you are allowed not to answer them. This interview will be recorded, an audio recording, and the access to the recording will be limited to only researchers this project. Is there anything you want to ask?
R	I think it is clear.
I	Ok. So, we start with the first question. Could you describe the supply chain structure of horticultural products in Indonesia, from farmers to market?

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R Ok. Thank you very much for choosing me as a respondent in your project.
Actually, related to the supply chain of horticultural products, there is no significant changes. It is not like in the transportation sector, for examples, there is on-line transportation, etc. In the horticultural supply chains, it is as usual. However, nowadays, farmers have more options with respect to finance, technology, from the aspect of market, etc. Actually, nowadays, there are many start-up companies. Start-up means that there is technology intervention that makes options for farmers, that in the past was very limited, now there are more options. So, farmers are more comfortable, so it is related to... they can focus on their production.
I am working for an agricultural financial technology company in Indonesia located in Jakarta. First, actually, this company is considered as s a new player in the supply chain structure, we were considered as disturber. As a new player in the supply chain systems, in the horticulture, livestock, etc. But, actually, with financial technology (fintech) itself... fintech comes as a new option for farmers as I said before. These new fintech or start-ups in agriculture is new options for farmers, because before this, there are many layers in the supply chains from farmers to market, from farmers to local traders then to markets, etc. Now, it is shorter and more transparent.

I This fintech, is the role of this fintech only in finance or also in market?

R Actually, the start-ups have already taken roles in all aspects of supply chain, from upstream to downstream, they have roles in the upstream, in the downstream, in the transportation, in the middle. Currently, there are many start-ups in agriculture. For fintech, it is an option for farmers to get capital. Beyond this, there are companies that focus on production, using drone, sensor, technology bases. Then, there are also companies that focus on information system development. So, farmers can update the price, characteristics of their locations, etc, following data or geospatial data from a university. Usually, they collaborate to develop an application, then it is developed and given to farmers to be used. In addition, there are companies that focus on market. Now, there are many start-up companies in Indonesia, the new start-up that become market place or e-commerce. But, for agricultural products, I think e-commerce is still appropriate. It is because the market place is to bring together farmers and their customers directly. However, there is a difference between the behaviour of farmer and the customers. Farmers usually sell product in the large quantity, while the demand of customers in the small quantity.

I So, there are start-up companies trying to bridge farmers with costumers. Are there any start-up companies who bridge farmers to supermarkets or export markets?

R Yes, usually, start-ups, in downstream, they have channels to markets. Comparing to when farmers sell their products to the local traders, farmers just sell products to the local traders. Usually in selling to the local traders, there is no transparency, such as how much the production costs, trend of price, etc, they usually don't know them. But, nowadays, where there is technology, there is transparency. Usually, the start-up companies, they have access to many markets, encompassing horeca, modern markets, home industries, or traditional markets, even export markets.

I Oh ok, so not only selling product to customers, but also supply products to other markets.
Now, let's talk about the governance, what are the differences between the governance between farmers and local traders and the governance between farmers and the start-up companies?

R Actually, the differences are quite significant. First, these start-ups use technology or innovation in their systems that make the supply chains are more proper. Actually, there is nothing wrong with the local traders because, so far, they the only actors who help farmers to live, so there is no other option for farmers to sell their products. So, there is nothing wrong with the local traders. The start-ups are established to offer new options to farmers. usually, these start-ups offer not only markets, but also other services. When farmer joined the local traders, they only focus on markets, but if they join the start-ups, they can receive the information, price information, so they will know it. They are also taught how to use the technology and how to make a good administration. So, the difference is maybe in the traditional supply chains they don't know anything, they only focus on production, selling crops, they get money, but they don't know whether the price covers the production cost. But through the start-ups, they are required to be able to do administration works, to know market information, to know new technology, understand the market channels. So, there is an opportunity for them to improve their knowledge and also income.

I Ok, understood.
Who are the start-up collaborate with, with the individual farmers or farmer groups?

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R There are start-ups who have partnership with individual farmers directly, but to maintain the economics of scale, they usually have partnership with farmer groups, even the joined farmer groups.
I So, in addition to take roles in market and finance, the service that usually local traders provide, the start-ups also give technical assistances in technology and administration.
R Yes.
I Ok.
So, when collaborate with farmer groups, are they the established farmer groups or, start-ups form new farmer groups?
R Usually, the rules are not too strict. Usually, the start-ups focus on the farmer groups that have been established, and farmers who are experts in their field. So, if there are farmers with lack of experience, they can join the farmer groups that are experienced in farming, so the head of farmer groups can coordinate the groups, so they can have more farmer members. Therefore, the productivity can increase and also the size of farm land, for example from 5 Ha to 20 Ha. So usually, we have partnerships with the established farmer groups.
I Ok.
Do you also cooperate with the government extension programmes.
R Usually, the start-ups have their own extension officers who are recruited to monitor the projects. In addition, they also cooperate with government and universities. So sometime... the start-ups are still not stable in the regulation, standard operating procedure, etc. They usually cooperate with other companies, such as with pesticide companies, seed companies, and also with government and universities.
I Ok. So, actually there is a hope for this new supply chain structure.
If you can estimate, how much the proportion of the horticultural product that goes to the start-up chains?
R I have no idea about the exact number, but if it is seen from the amount of credit from the fintech that has been absorbed by farmers (not only horticulture), it has already reached about Rp 1 trillion (about 57.151.100 euro).
I Ok.
Still related with the governance. One of the reasons why farmers very rely on local traders is because when they need a loan, it is very easy, they can ask anytime, and they pay it after harvesting their crops. It is different with the rule of commercial banks. What about the rule of credit from the start-up companies?
R Ok. Actually, the rule can be easier than the rules of banks, but not as easy as the rule from local traders. But, the interest rate is monitored by the finance authority. So, if getting loan from the local traders, for examples, today we borrow Rp 1 million, then when we pay it become Rp 1,1 million, so we can calculate how much the interest rate. Meanwhile, the interest rate from the fintech, it has been ruled by the finance authority.
The process of getting credit from the fintech is easier than the process in the bank. It is because the fintech is not required the collateral, because it is not allowed. Usually they use personal or corporate guarantee, for example a farmer joins an institution. The required documents are more simple than the requirement of banks. Some of the basic rules have been determined by the authority.
I Ok.
Talking about the supply system. If farmers sell products to local traders, they sell them ungraded, what about supplying products to the start-up companies?
R It depends on the start-up companies. There are start-ups that usually buy products ungraded. It is to make farmers focus on their farming activities. But, there are also star-ups who require graded products, such A, B, C. It is to encourage farmers to not only planting crops but also to learn about product quality, so they will now about the product specification, especially for modern markets or other markets. So, they will now, for example the specification of tomato, etc. So, there is a knowledge transfer process from the fintech company to farmers. So, there are start-up companies that buy ungraded and also graded products.
I Ok.
Now let's move on to the topic of challenges. Could you explain, what are challenges faced by horticultural supply chains in Indonesia?

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R Ok. For horticulture, more specifically green vegetables, it is the products that cannot be distributed widely, it is usually distribute in domestic area. One of the challenges is every region has different productivity, while the demand is also different. So, the challenge is how to maintain the productivity of this product.
Second, how we can start to do cold chain systems in Indonesia. The horticultural products have short self-life compared to other products, such as plantation products, etc. Then, for horticultural product, how we change the mindset of costumers. The customers consider the good products are products without the scratch. Now there are campaigns to inform that the good product cannot be seen from the outside condition only. So, the customer preferences should be changed.
So, first is to maintain the productivity, then cold chain system development, from upstream to downstream to maintain the quality, quantity and freshness, the third is the customer preferences.

I Ok. Is there anything else?

R For horticulture, the challenge of market. There are a lot of markets that buy products ungraded, so there is no development in the farming activities of farmers. Farmers only think how to plant crops. They don't know the market requirements. So, maybe it has to be changed.

I Yes, I agree.
Ok. Let's move on to the topic of farmer group. Could you explain the types of farmer groups in Indonesia? and what are the differences between them.

R Actually, I don't know much about the farmer group. As I understood there are farmer groups, joined farmer groups, cooperative. That is all.

I Oh, it's ok
As far as you understood, maybe you have experience cooperate with farmer groups, what are challenges face by the farmer groups to develop and to be sustainable? They are many reports, also from previous interviews, stated that farmers are reluctant to join the farmer groups and when they join the farmer group, many farmer groups are not sustainable

R Oh, maybe how the farmer groups can be maintained and developed?

I Yes.

R Maybe the goals have to be clear for farmers. First, the goals should be clear. As I know there is a government programme called "one village one product", so maybe it can be connected to this programme. When there are farmer groups, what are their focus, and who they will collaborate with. Usually, the start-ups in agricultural sector, they are not alone. Usually they collaborate with others, such as with seed companies. They come in a big group to farmer groups. So, usually the farmer groups were confused, they established the farmer groups, but they didn't know how to sell their products. With the start-ups, usually, the goals are clear, there is knowledge transfer process. So, to enable the sustainability of farmer groups, maybe we have to make the clear vision and mission of the farmer groups, where they sell their products, who they collaborate with. I think that's all.

I Ok. Is there anything else you want to add regarding the farmer group?

R Regarding the farmer groups, maybe it needs more farmer groups that are legalised. It is because with legalisation, the access of farmer groups to the finance, partnership with other actors will be easier compared to the farmer groups without legalisation. Usually, the legal farmer groups can be easier to collaborate, because they have legalisation.
In addition, maybe in the internal farmer groups, how to build the bonding between farmer members.

I Ok.
Now, let's talking about the agricultural extension programmes, maybe you have the information or experience about the agricultural extension, the government agricultural extension programmes. Actually, what are the roles of agricultural extension programmes in the horticultural supply chains in Indonesia?

(Continued)

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R Ok. I conducted survey... our company conducted many surveys to farmer groups, how the process of extension programmes looks like. We asked farmers, is there agricultural extension programme, or is there an impact from the agricultural extension programmes. Mostly, farmers feel that the extension officers give information that don't suit the phenomena that is happening. For example, there is an X pest in their chillies, but the extension officers give trainings not related to this kind of pest, but they give the material that are provided in their backlog. The importance is they work, they have the information and they deliver it to farmers. Whether it is appropriate or not... it is what farmers said, usually it is not appropriate. Then, there are many programmes, such as aids in kind of tractor, pesticides, fertilisers... tractors were given to farmer in the valley area, so that is not appropriate. So, the government programmes should be appropriate with characteristics of regions.

I So, the programmes are not appropriate with the farmers' needs.

R Yes, sometimes also the extension programmes... Sometimes, farmers have more knowledge than the extension officers, because they do farming activities every day. So, sometimes, they don't trust the extension officers. What they need is the field experiments. It is more effective when the big companies come and perform the field experiment programmes. They prefer this because they can see the results. Maybe, because from the government extension programmes is only the theory.

I It has been mentioned that there are also technical assistances from the start-up companies. Could you explain more about it, and what are the differences with the government extension programmes?

R I don't know much about the process in the government extension programmes, maybe it can be validated. From the government, usually they give information, when there is new information, they come and disseminate the information to farmers. But, it is still a question whether this new technology is appropriate or not.
From the start-ups, usually the start-ups have cooperation with other companies. In the past, the companies come by themselves to give technical assistance to farmers, also the government. Now, through the start-ups, we bring them together, make field experiments and give farmers technical assistances. In addition, there are also technical assistances from universities. As it is mentioned, the start-ups always come to farmers in a group, for examples from the fintech, from the seeds, from the pesticides, they collaborate to develop a product in a region. It is because we support the government programme of one village one product. So, we join and build the group with them, come to certain villages, and give technical assistances to farmers, then there is also university. The start-ups also do weekly monitoring, and usually they share information with farmers. What I heard from farmers, they prefer this system, because from government usually only come 1-2 times a month. With the start-ups they can share information every week.

I Ok. The programme is clearer.

R Yes, the programme should be clear.

I Is there anything else you want to add?

R I think that's all.

I Ok.
Now, let's move on to the last topic, that is about food safety. Could you explain, how every actor, from farmers, local traders, markets, start-ups, address the issue of food safety in horticultural products?

R There is a case, it is conducting by our company, so the case is the development of cashew and rice for organic, the organic cashew and rice. So, the demand comes from other country. So, there is a company from that country come to us, usually the approach is directly to the government, then the government look for the partner, or the PIC. Actually, now there are farmers who are aware of what market needs, in the past they didn't now it. Now, they know commodity with high value such as hydroponic, organic. Because of the capital, usually the collaboration is with financing company, with the institutions that give certification, come to certain villages talk with farmers, inform them that there is a market for organic product, and there is the standard for the organic. Usually they are interested. If we explain about the value, how much the cost, how much the value, usually they are interested, because farmers are also realistic, from this effort, when they get the certification, they pay for example Rp 10 million, how much will I earn. With the transparency of information, they usually want to join.

I So, it should be the value for this issue.

R Yes, it is right.

I What about most farmers, are they concern on it?

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R	Now, because of technology, so, they are more aware, maybe because I am from the AgriTech company, a start-up, there are more farmers who are aware. They have started to think business. In the past they think the importance is they can buy rice for eating, now they have started to think how to expand their business. From the farm labours, there is an increase in the labour wage.
I	Is there anything else you want to add about the food safety?
R	Usually, for food safety standards, GAP, ISO, usually it needs the technical assistances. Farmers cannot do it by themselves. Most farmers don't do that, except the companies. For most farmers they have not started yet. So, it needs the technical assistances, needs knowledge sharing what value are offered.
I	Ok. I think it has finished. Thank you very much for your time and information. If there is some information missing, is it ok if I contact you again?
R	Yes. It's ok.

Appendix 5.Challenges and solutions of local traders

Challenge	Solution
Production	
Most produce supplied by farmers has low quality	Two solutions: - Farmers do better farming activities (use good quality of seeds, regular fertilizing, spraying, crop maintenance, etc.) - Find appropriate seeds for their location
Pest and disease causing low supply and a lot of rejected produce	–
Finding ways to help farmers to improve their farming methods	–
Market	
Price of Grade A from exporters is low	Negotiate with exporters regarding price
Payment from exporters takes long time (about 4 weeks)	Lower the supply to exporters to deal with longtime payment
The change of volume order from exporters	–
Finding markets to sell off-grade produce	Use off-grade produce that cannot be accepted by market as animal feed
Logistics	
Loyalty of farmers to only supply produce to local traders who give them credit	Five solutions: - Choose trusted farmers in giving credit - Consequences for farmers who are not loyal - Record keeping to control supply produce of farmers who have credit - Talk to local traders who are going to buy produce form their farmers - Negotiate with farmers who have credit regarding selling system
Finance	
Getting more capital to give farmers credit	Try to get credit from funding institutions
Institutions	
Getting access to government programs	Three solutions: - Establish a formal farmer group initiated by the local traders who involved in the workshop - Ask Unpad to help them in establishing a formal farmer group - Find information how to make a good proposal to apply government programmes
Better communication with farmers especially about the price fluctuation at traditional markets	–

Appendix 6.Challenges and solutions of farmers

Challenge	Solution
Production	
Yield and produce: - Low productivity (2 groups) - Low quality of produce (1 group)	Farming method: - Better farming method (1 group) - Producing good quality of seeds (1 group)
Dealing with soil condition (e.g. pH) (1 group)	Find information about pH soil measurement, then do soil treatment based on pH condition (1 group)
Finding technique to intercrop some kinds of crops (e.g. bean) (1 group)	Wider space between plants in intercropping and select appropriate kinds of crops to be intercropped (1 group)
Pest and diseases: - Dealing with a lot of pest and diseases (4 groups) - Appropriate pesticides for pests and diseases (2 groups)	Pest and diseases: - Use pesticide regularly (1 group) - Kill pests manually (1 group) - Find information about appropriate pesticides for certain kinds of pests and diseases (1 group)
Price of good quality of production inputs (seeds, fertilizers, pesticides) are expensive (2 groups)	Production inputs: - Produce and use more compost for fertilizing (2 groups) - Government subsidies in production inputs (seeds, fertilizers, pesticides) (1 group)
Quota of fertilizers from production input shops is limited (1 group)	Buying fertilizers: - Buy fertilizers as a group (when they have a farmer group) to get more quota (1 group) - Make a stock for fertilizers (1 group)
Water shortage in dry season (4 groups)	irrigation: - Build small reservoir to catch water in rainy season to be used at dry season (2 groups) - Local government regulation in organizing the flow of water from the sources (3 groups) - Continue to work together to repair irrigation channels. (3 groups) - Using pump machines to lift water from sources (2 groups) - Make simple sprinklers (1 group) - Government build good irrigation system (1 group) - Use plastic mulch to maintain humidity of soil (1 group)
Labour shortage in the beginning of rainy season (2 groups)	Dealing with labour shortage: - Get labour from outside area (1 group) - Reduce the size of cultivated land (1 group) - Do some activities by themselves (2 groups) - Use technology such as tractors (1 group)
There is no standard in rent land price (2 groups)	–
Market	

(Continued)

Appendix 6 (continued)

Challenge	Solution
Price: - Price fluctuation (3 groups) - No contract in price between farmers and local traders (2 groups) - Price from local traders is low (1 group) - No information about kind of crops planted by farmers in other locations to anticipate a drop in price (2 groups) - No planning in planting crops due to lack of knowledge in predicting price (1 group)	Dealing with challenges of price: - Government regulation in price of vegetables (3 groups) - Contract in price between farmers and local traders (3 groups) - More transparent in price from local traders. (1 group) - Information from government regarding planting schedule other farming areas (1 group) - local traders coordinate planting schedule of farmers (3 groups) - local traders should expand their markets to get higher price and to deal with price fluctuation (2 groups)
Farmers do not have market option but local traders (1 group)	Government programs to market farmers' produce (1 group)
Payment from local traders is not in cash (2 groups)	–
Transportation	
Bad condition of road connected farmers' land (2 groups)	Dealing with bad condition of road: - Continue to work together to improve road (2 groups) - Apply proposal to government to improve road (1 group)
High transportation cost (1 group)	–
Finance	
Lack of capital and credit: - Limited capital owned by farmers (1 group) - Lack of access to formal funding institutions (1 group) - Requirement of funding institution does not match with farming characteristics. (1 group)	Dealing with challenges of capital and credit: - Establish a cooperative that can give farmers credit (3 groups) - There should be funding institutions for farmers (1 group)
Difficulty in managing money for farming activities and for living (1 group)	Managing money: - Farmers should separate money for farming activities and for living (1 group) - Make record keeping of farming activities (1 group)
Institutions	
Sharing and communication : - Farmers do not have a medium for sharing ideas and experience (1 group) - Communication between farmers and local traders (1 group)	Regular meeting between farmers and local traders (3 groups)
Farmer group: - The absence of farmer group (1 groups) - Farmers less knowledge about the advantage of farmer group (1 group) - Farmers have no ideas how to establish a formal farmer group (2 groups) - Limited access and information to government programs (2 groups)	Dealing with the challenge of farmer group: - Establish formal farmer groups to get access to government programmes, including agricultural extension programmes (2 group) - Training in establishing a farmer group (1 group)

(Continued)

Appendix 6 (continued)

Challenge	Solution
There is no access to agricultural extension services (4 groups)	Dealing with the absence of extensions: - Asking agricultural extension to give trainings and field visits (3 groups) - local traders give farmers technical assistances in farming (1 group)

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SUMMARY

Summary in English...

Participation of actors is essential for achievement of the United Nation's (UN) Sustainable Development Goals (SDGs). With respect to sustainable agriculture the UN has introduced a collaborative framework for food systems transformation encompassing: 1) food system champions identification; 2) food systems assessment; 3) multi-stakeholder dialogue and action facilitation; and, 4) strengthen institutional capacity for food systems governance. The last two actions are the focus of this thesis.

Sustainable agriculture involves multiple actors connected horizontally and vertically through agricultural production and supply chain (APSC) networks in which every actors' decisions and actions are affected by, and affect most, if not, all other actors. Involvement of every actor in the APSCs is essential to enable coordination for sustainable agriculture.

Most previous programmes to pursue sustainable agriculture, however, still follow the top-down approach in which local actors are considered as passive entities encouraged to adopt initiatives designed by external actors (e.g. governments, universities, NGOs). Most often, this results in unsustainability of programmes due to the incompatibility of initiatives with factors related to local context. In addition, most programmes focus on horizontal relationships between farmers to deal with encountered challenges, e.g. in production, market, finance.

This thesis proposes a different approach that focuses on the participation of actors connected horizontally and vertically in APSCs to (by the actors themselves): analyse situations; design initiatives; and take actions (through working together) to pursue sustainable and workable APSCs.

Research through Design (RtD) combined with Action Research, more specifically, Participatory Action Research (PAR) is performed with cases of APSCs in Indonesia, more specifically in the horticultural sector. As most farmers in Indonesia are smallholder farmers (about 93%) with lack of knowledge, information, and capital, Indonesia can be considered to be exemplary for APSCs in developing countries.

As most smallholder farmers (including in Indonesia) do not recognise opportunities for sustainable APSCs, empowerment is of importance. This thesis addresses the question: "Can agricultural chain actors (connected vertically and horizontally) in Indonesia be empowered to pursue sustainable APSCs?". Three concepts that are the foundation of this research are identified: agricultural production and supply chains; empowerment; and co-creation (an approach for empowerment).

The first step to answer this question is taking lessons learnt from previous programmes of sustainable agricultural development (SAD) in developing countries. For this, a framework of sustainable APSCs is introduced in this thesis: Participatory Sustainable Agricultural Development (PSAD). The framework focuses on the principles of participation on which most previous frameworks do not focus. This framework was used

to analyse previous SAD programmes in developing countries. The results show that, in addition to environmental and economic factors, social factors of empowerment and engagement have shown a positive effect in pursuing sustainable APSCs. In addition, continued facilitation in a follow-up programme is also essential to pursue sustainable APSCs.

Based on these results, an approach to empower APSC actors has been designed in this thesis: COCREATE. COCREATE empowers local actors to engage in designing initiatives to be implemented by local actors themselves (through working together) to deal with their situations. For this, pursuing a common understanding of involved actors on their common situations is essential. COCREATE consists of design and implementation activities, and the process of these activities is cyclic with continuous feedback. Reflection is one of the essential elements with which this approach pursues common understanding that most previous approaches do not include. Meanwhile, with respect to actors, COCREATE involves actors that are connected both horizontally and vertically in the APSCs in which power imbalances exist.

COCREATE, in this research, was implemented in multiple cases of APSCs in Indonesia, more specifically with local trader-farmer groups and a farmer organisation (FO), more specifically with a group of farmer groups, in which most smallholder farmers were involved. Both cases are located in a horticultural production centre in Indonesia, in Bandung District, West Java.

Local trader-farmers groups, representing the primary vertical relation in the chain, consist of a local trader and farmers connected through traditional chain governance (i.e. local trader provides finance to farmers, consequently farmers must sell all their produce to the local trader). Even though they depend on each other in their APSCs systems, there is lack of incentive alignment in their relationships. In fact, many problems arise due to, e.g. lack of information transparency, unfair chain governance, lack of commitment. Meanwhile, an FO, representing horizontal relations in the chain, consists of farmers connected through organisational governance to enable them to do collective actions, including getting access to markets. The FO in this case is a group of farmer groups (GFG) that faced challenges of the commitment of farmer members, internal information flow, bottlenecks in the production and supply chain, and, financial arrangements as a consequence of the growth in market and membership (also known as being successful).

In the implementation of COCREATE with cases of both local trader-farmers groups and a GFG, participants were able to apply the sequence of procedure in design activities, including reflection. It resulted in common understanding improvement of involved actors of their situations that can be seen from solutions co-created and agreed by them. In the implementation activities, participants (in cases of local trader-farmers groups and GFG) were able to organise themselves to implement agreed solutions. Meanwhile, in the follow-up design, they were able to evaluate and adapt the solutions to address the changes in situations. Facilitators, in both cases, played important roles to ensure the procedure of COCREATE (including reflection) was implemented appropriately supporting participants by providing the information needed and facilitating access to external parties when asked to by the participating actors.

In the case of local trader-farmers groups, COCREATE implementation resulted in a

change in relation and task division between farmers and local traders (in each group), improving market position and institutional arrangements between them. Meanwhile, in the case of a GFG, COCREATE implementation resulted in the ability of the GFG to self-organise their governance to deal with the challenges identified.

Based on the results, this thesis concludes that: 1) social factors of empowerment and engagement are essential to pursue sustainable APSCs, in addition to environmental, economic and governance factors; 2) COCREATE is an approach to empower APSCs actors (connected horizontally and vertically) in developing countries to engage in pursuing sustainable and workable their APSCs; 3) COCREATE supports farmers and local traders (in the vertical relationships) to improve their own and each other position in the APSCs; 4) COCREATE supports farmer organisation (in the horizontal relationships) to self-organise their governance to maintain sustainable inclusion; 5) Empowering agricultural chain actors in developing countries is a long-term process and requires new approaches within, e.g. extension programmes, local university programmes as well as private business interventions.

SAMENVATTING

Samenvatting in het Nederlands...

Om de Sustainable Development Goals (SDGs) van de Verenigde Naties (VN) te halen is het essentieel dat alle betrokken partijen meedoen. Met betrekking tot duurzame landbouw heeft de VN een samenwerkingskader geïntroduceerd voor de transformatie van voedselsystemen. Dit kader omvat: 1) identificatie van de wegbereiders voor nieuwe voedselsystemen; 2) beoordelingssystematiek voor voedselsystemen; 3) dialogen met meerdere belanghebbenden (multi stakeholders) en het ondersteunen van acties of projecten; en 4) het versterking van de institutionele capaciteiten voor de besturing van voedselsystemen. Deze laatste twee acties staan centraal in dit proefschrift.

Bij duurzame landbouw zijn meerdere actoren betrokken die horizontaal en verticaal met elkaar verbonden zijn via landbouwproductie- en toeleveringsketennetwerken (APSC= Agricultural Production and Supply Chain) waarin de beslissingen en acties van elke actor worden beïnvloed door, en invloed hebben op de meeste, zo niet alle andere actoren. Betrokkenheid van alle actoren bij de APSC's is essentieel voor een werkbare coördinatie van duurzame landbouw.

De meeste bestaande programma's voor duurzame landbouw, volgen echter nog steeds de top-downbenadering, waarbij lokale actoren worden beschouwd als passieve deelnemers die worden aangemoedigd om zich in te zetten voor initiatieven die zijn ontworpen door externe partijen (bijv. overheden, universiteiten, NGOs). Meestal resulteert dit in onhoudbare programma's omdat de initiatieven niet stroken met bepaalde factoren uit de lokale context. Bovendien richten de meeste programma's zich op de horizontale relaties tussen boeren onderling om daarmee problemen op te lossen, zoals rondom productie, markt en financiën.

Dit proefschrift stelt een andere benadering voor die zich richt op de deelname van zowel horizontaal als verticaal verbonden actoren in APSC's om (door de actoren zelf): situaties te analyseren; initiatieven te ontwerpen; en acties te ondernemen (door samen te werken) om duurzame en werkbare APSC's na te streven.

Research through Design (RtD) gecombineerd met Action Research, specifiek Participatory Action Research (PAR), is uitgevoerd met case studies van APSC's in Indonesië, specifiek in de tuinbouwsector. Aangezien de meeste boeren in Indonesië kleine boeren zijn (ongeveer 93%) met een gebrek aan kennis, informatie en kapitaal, kan Indonesië worden beschouwd als een typisch voorbeeld voor APSC's in ontwikkelingslanden.

Omdat de meeste kleine boeren (ook in Indonesië) de kansen voor duurzame APSC's niet zien, is empowerment (ontwikkeling van eigen kracht) van belang. Dit proefschrift behandelt de vraag: "Zijn actoren in de landbouwketen (verticaal en horizontaal verbonden) in Indonesië in staat om duurzame APSC's vorm te geven?". Drie concepten vormen de basis van dit onderzoek: landbouwproductie en toeleveringsketens; empowerment; en co-creatie (een aanpak voor empowerment).

De eerste stap om deze vraag te beantwoorden, is lering trekken uit eerdere programma's voor duurzame landbouwontwikkeling (SAD) in ontwikkelingslanden. Hiervoor wordt in dit proefschrift een raamwerk van duurzame APSC's geïntroduceerd: Participatory Sustainable Agricultural Development (PSAD). Het raamwerk richt zich op de principes van participatie waarop de meeste eerdere raamwerken niet focussen. Dit raamwerk werd gebruikt om eerdere SAD-programma's in ontwikkelingslanden te analyseren. De resultaten laten zien dat, naast ecologische en economische factoren, sociale factoren van empowerment en betrokkenheid een positief effect hebben bij het vorm geven van duurzame APSC's. Daarnaast is voortdurende facilitering in een vervolgprogramma ook essentieel om duurzame APSC's na te streven.

Op basis van deze resultaten wordt een aanpak in dit proefschrift een aanpak beschreven waarmee APSC-actoren hun gezamenlijke kracht ontwikkelen: COCREATE. COCREATE stelt lokale actoren in staat om deel te nemen aan het ontwerpen van initiatieven die door lokale actoren zelf kunnen worden geïmplementeerd (door samen te werken) om hun situaties naar eigen inzicht te verbeteren. Hiervoor is het essentieel om een gemeenschappelijk begrip door de betrokken actoren te laten ontwikkelen over hun situatie. COCREATE bestaat uit ontwerp- en implementatie activiteiten, en het proces van deze activiteiten is cyclisch met continue feedback. Reflectie is een van de essentiële elementen waarmee deze aanpak een gemeenschappelijk begrip nastreeft dat in de meeste eerdere methodieken niet voorkomt. Tegelijk betrekt COCREATE met betrekking tot actoren partijen, die zowel horizontaal als verticaal zijn verbonden in de APSC's, waarin machtsongelijkheden bestaan.

De methode COCREATE werd geïmplementeerd in meerdere case studies van APSC's in Indonesië, met lokale handelaar-boerengroepen en een boerenorganisatie (FO), meer specifiek met een groep boerengroepen, waarin veel kleine boeren betrokken waren. Beide case studies bevinden zich in een tuinbouwproductiecentrum in Indonesië, in het Bandung-district, West-Java.

De combinatie lokale handelaar en boerengroepen, die de primaire verticale relatie in de keten vertegenwoordigen, bestaan uit een lokale handelaar en boeren die verbonden zijn via traditioneel ketenbeheer (d.w.z. dat de lokale handelaar financiert aan boeren, waardoor boeren al hun producten aan de lokale handelaar zouden moeten verkopen). Hoewel ze binnen de APSC-systemen van elkaar afhankelijk zijn, is er een gebrek aan prikkels om de relaties af te stemmen. In feite ontstaan veel problemen als gevolg van b.v. gebrek aan transparante informatie, oneerlijk ketenbeheer, gebrek aan commitment. Ondertussen bestaat een FO, die horizontale relaties in de keten vertegenwoordigt, uit boeren die verbonden zijn via een organisatiestructuur waarmee collectieve acties worden ondernomen, onder anderen het krijgen van toegang tot markten. De FO is in dit geval een groep boerengroepen (GFG) die te maken kreeg met uitdagingen zoals de inzet van boerenleden, interne informatiestromen, knelpunten in de productie- en toeleveringsketen en financiële regelingen als gevolg van de groei in markt en aantal leden (met andere woorden een succesvolle groei doormakend).

Bij de implementatie van COCREATE met cases van zowel lokale handelaar-boerengroepen als een GFG, konden de deelnemers de volgorde van de procedure toepassen in ontwerpactiviteiten, inclusief reflectie. Het resulteerde in een verbetering van het gemeenschappelijk begrip van de betrokken actoren in hun situatie, die zich toont in de oplossin-

gen die door hen zijn ontwikkeld en overeengekomen. Bij de implementatieactiviteiten konden de deelnemers (in het geval van lokale handelaar-boerengroepen en GFG) zich organiseren om de overeengekomen oplossingen te implementeren. Vervolgens konden ze in het vervolgontwerp de oplossingen evalueren en aanpassen aan de veranderingen in situaties. Facilitatoren speelden in beide gevallen een belangrijke rol om ervoor te zorgen dat de procedure en structuur van COCREATE (inclusief reflectie) op de juiste manier werden toegepast, om de deelnemers te ondersteunen door de benodigde informatie te verstrekken, en de toegang tot externe partijen te vergemakkelijken, maar alleen wanneer daarom werd gevraagd door de deelnemende actoren.

De implementatie van COCREATE resulteerde in het geval van de lokale handelaar-boerengroepen in een verandering in de relatie en taakverdeling tussen boeren en lokale handelaar (in elke groep), waardoor de marktpositie en institutionele afspraken tussen hen werden verbeterd. Ondertussen, in het geval van een GFG, resulteerde de implementatie van COCREATE in het vermogen van de GFG om hun bestuur zelf te reorganiseren om de geïdentificeerde uitdagingen aan te kunnen pakken.

Op basis van de resultaten concludeert dit proefschrift dat: 1) sociale factoren van empowerment en betrokkenheid essentieel zijn om duurzame APSC's na te streven, naast milieu-, economische en bestuurlijke factoren; 2) COCREATE is een aanpak om APSCs-actoren (horizontaal en verticaal verbonden) in ontwikkelingslanden in staat te stellen deel te nemen aan het streven naar duurzame en werkbare APSCs; 3) COCREATE ondersteunt boeren en lokale handelaar (in de verticale relaties) om hun eigen en elkaars positie in de APSC's te verbeteren; 4) COCREATE ondersteunt boerenorganisaties (in de horizontale relaties) om hun bestuur zelf te organiseren om duurzame inclusie te behouden; 5) Het versterken van actoren in de landbouwketen in ontwikkelingslanden is een lange termijnproces en vereist nieuwe aanpakken binnen bijvoorbeeld landbouw voorlichtingsprogramma's, lokale universitaire programma's en particuliere zakelijke interventies.

CURRICULUM VITÆ

Kusnandar Kusnandar was born in Garut, Indonesia on 23 July 1979. He studied agricultural engineering in the Faculty of Agriculture, Padjadjaran University, Indonesia from 1998-2003. From 2003-2010, he worked for Research Institute and Community Service Padjadjaran University (LPPM-Unpad) as a research assistant. In 2008, he started his master study in Industrial Engineering and Management, Bandung Institute of Technology, Indonesia. He earned his master degree in 2010. Since 2010, he has been working for Research Centre for Science, Technology and Innovation Policy and Management, Indonesian Institute of Sciences (P2KMI-LIPI) as a researcher. In 2015, he was awarded a PhD scholarship by The Ministry of Research and Technology of the Republic of Indonesia. Since August 2015, he has been pursuing his PhD programme in Systems Engineering Section, Department of Multi-Actors Systems, the Faculty of Technology, Policy and Management, Delft University of Technology, the Netherlands.

His PhD research focuses on designing an approach, based on participatory systems, to empower agricultural chain actors in developing countries to pursue sustainable agricultural production and supply chains. His main research interests are in agricultural production and supply chains, participatory design including co-creation approach, and complex systems.

LIST OF PUBLICATIONS

1. Kusnandar, K., O. van Kooten, & F. M. Brazier. COCREATE: A Self-directed Learning Approach to Agricultural Extension Programmes. *Accepted in Development in Practice (November 2020)*

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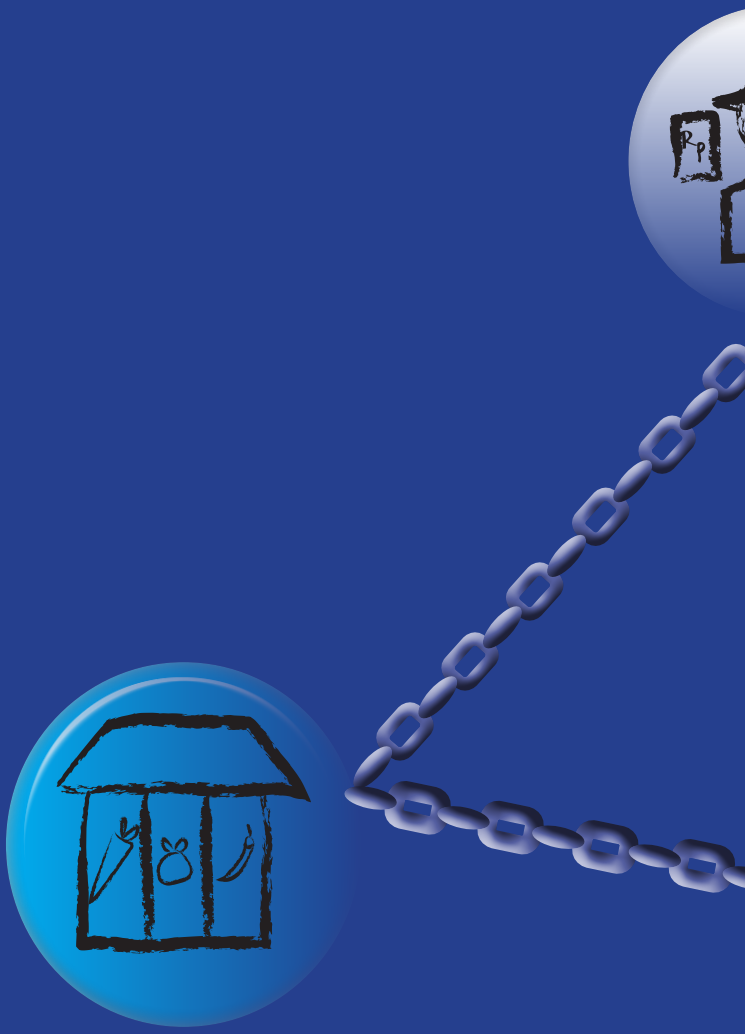

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