Space for Change: The role of research in supporting institutional innovation for Agricultural Research for Development in Rwanda

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Abstract

Rwanda has embarked on a journey of agricultural transformation. This study explores the concept of institutional innovation in agricultural research & development and the role of consortiums like CIALCA in facilitating institutional change. Understanding how institutional innovation can be supported can create a more open and tolerant environment for (agricultural) innovation with more opportunities for change. Institutional innovation was explored through active enablers (actors and resources) and passive enablers (rules and time) via interviews and a participatory assessment workshop with stakeholders. Disseminating agricultural innovations through strategies of learning is strongly effected by the relationship between active and passive enablers in the institutional environment. The characteristics of the stakeholder group (homogenous or heterogeneous) play a role in the alignment of a knowledge package with the recipients' need for information. Also an institutional division between cash and food crops ask for a different approach in supporting institutional change. Furthermore, interdisciplinary research, coming from political and economic studies might helps to respond to questions that are not agronomic (technical) in nature. This could help decision makers to get a better overview of the necessary changes to cognitive, normative and regulative rules, which are needed to support, embed and sustain a new innovation.

Keywords: agricultural innovation, institutional innovation, AR4D, institutional theory, integrated systems

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List of acronyms

AGRA	Alliance for a Green Revolution in Africa
AR4D	Agricultural Research for Development
BCI	Banana-Coffee Intercropping
CGIAR	Consultative Group on International Agricultural Research
CIALCA	Consortium for Improving Agriculture-based Livelihoods in Central Africa
CIP	Crop Intensification Program
CoE	Cup of Excellence®
EDPRS	Economic Development and Poverty Reduction Strategy
DGDC	Directorate-General for Development Cooperation, Belgium
IITA	International Institute of Tropical Agriculture
NIBAP-IPGRI	International Network for the Improvement of Banana and Plantain & International Plant Genetic Resources Institute (now called 'Bioversity international')
ISAR	Rwanda Agricultural Research Institute
ISFM	Integrated Soil Fertility Management
MDG	Millennium Development Goals
MINAGRI	Ministry for Agriculture and Animal Resources, Rwanda
NAP	National Agricultural Policy
NAEB	National Agricultural Export Development Board
NARS	National Agricultural Research Systems
NEPAD	New Partnership for Africa's Development
NCS	National Coffee Strategy 2008-2012
OCIR CAFÉ	Rwanda Coffee Authority
SPTA	Strategic Plan for the Transformation of Agriculture in Rwanda
R4D	Research for Development
RAB	Rwanda Agricultural Board
RADA	Rwanda Agricultural Development Authority
RARDA	Rwanda Animal Resources Development Authority
TSBF-CIAT	Tropical Soil Biology and Fertility Institute of the International Centre for Tropical Agriculture.
USAID	United States Agency for International Development

1. Introduction

Despite its conflict ridden past of colonial rule and a disruptive genocide; Rwanda has embarked on a journey of recovery and reconstruction. This process started in 2000 when the Rwanda government launched a development program with a clear vision for the future to transform Rwanda into a more prosperous country. The Vision 2020 development program is '*a reflection of our aspiration and determination as Rwandans, to construct a united, democratic and inclusive Rwandan identity, after so many years of authoritarian and exclusivist dispensation*', President Paul Kagame writes in his foreword (MINECOFIN, 2012). The aim of Vision 2020 is to transform the country into a knowledge-based middle-income economy. The document introduces a framework for the development of Rwanda. With strategic development pillars, the program aims to support national unity, improve healthcare, education and reduce poverty (MINECOFIN, 2000). The Vision was implemented by constructing other policies that focussed on the specific development pillars.

In line with the ambition to reduce poverty, the government outlined a poverty reduction strategy paper (PRSP) in 2001 (MINECOFIN, 2002). The second PRSP, now called the Economic Development and Poverty Reduction paper (EDPRS) included a Strategic Plan for the Transformation of Agriculture (SPTA) that was introduced in 2004 (Damme, Ansoms, & Baret, 2013) (MINAGRI, 2004). The SPTA framework promoted and supported a modern agricultural sector based on intensification, professionalization and enterprise development (Ansoms & Rostango, 2012). The aim of the framework is to lead farmers from subsistence farming into productive high value and market oriented farming (Ansoms A. , 2009). By supporting agricultural intensification and agricultural modernization, the government tries to reduce the number of Rwandans relying on agriculture as a way of livelihood so they can become employed in other sectors of the economy. This part of the Vision is important in order to achieve the goal of becoming a middle-income economy.

The scale of this ambition is presenting huge challenges to its implementation. About 75-78%% of Rwandans depend on agriculture as livelihood (Cioffo, Ansoms, & Murison, 2016). The livelihood is largely based on subsistence farming. Land scarcity gives an average plot-size of 0.75ha, which presents challenges to more market-oriented farming (Huggins, 2014) (Cioffo, Ansoms, & Murison, 2016). The country has the high population density of 430 people per square km and this population is growing. Food production for the increasing population needs to happen on scarcely available land. Furthermore, soil degradation presents long-term risks to crop yields (Schut, et al., 2016).

The government's ambition to 'break with the past' (Huggins, 2014) makes them determined to overcome the challenges and exposes farmers to radical changes. The Rwandan agricultural development policies are implemented with a classic top-down approach, where development is engineered by the highest level of authority and where law is used as an instrument of (human) control. (Ansoms A. , 2009). Agricultural policy is implemented from the highest level to district and local levels via a network of decentralized authorities. In this Rwandan development system, the chain of

accountability goes upwards from local officials to superiors instead of downwards to population. This upwards accountability is institutionalised with so called 'performance contracts' or 'imihigo' (Ingelaere, 2010). Performance contracts have a huge influence upon the decisions, choices and behaviour of actors in the innovation system. Farmers have limited power to influence decisions and local authorities have limited space to adjust policies to the local agricultural needs. The performance contract is important in the agricultural innovation system and is widely used on all administrative levels from the government, to executive secretaries overseeing a district and even towards small farmer cooperatives. (Huggins, 2014).

The government of Rwanda reports a successful implementation of the SPTA for agricultural development (MINAGRI, 2009). But despite positive numbers there is a growing body of critical literature from the academic world. Scholars are analysing the impact of Rwanda's transformation programs in all layers of society. The impact policies seem to be especially disruptive amongst the poorest farmers of the country (Damme, Ansoms, & Baret, 2013). The transformation policies are affecting every aspect of their livelihood, from reorganized housing in villages called 'imidugudu' to imposing cropping techniques (Ansoms A. , 2009) (Ingelaere, 2010) (Huggins, 2014). The academic literature criticizes the government for being paternalistic: decisions are taken by a select few (elite) that give citizens what they need, but does not give them any responsibility or freedom of choices (Ingelaere, 2010). The elite is being accused of being too disconnected from the farmer's way of life and institutions. This leads to a style of agricultural development that has become a coercive field. (Huggins, 2014). In return, the elite accuses farmers of not having the right 'mind-set' when it comes to development. They see poverty as a state of mental dependence that can be overcome with deliberate choice (Ansoms A. , 2009).

The government of Rwanda, Rwandan farmers and the academic world have different ideas about how development can be governed. The development policies in Rwanda show a strong top-down and technocratic style of supporting change, innovation and transition. A select group of actors take decisions on the basis of technical knowledge. This style stands in contrast with academic ideas about agricultural development. Scholars of (agricultural) innovation agree that development is not purely a technical issue, but involves a holistic understanding of a system (Leeuwis, 2004). The AIS approach emphasizes that agricultural innovation is a joint endeavor of both technological innovation and institutional innovation (Klerkx, 2010). In the AIS approach, innovation is considered the result of a process of networking and interactive learning among actors, of the industry, such as farmers, input industries, processors, traders, researchers, extensionists, government officials, and civil society organizations.

To fully understand the 'stage' for change, one needs to preform an integrated analysis of dimensions, levels and stakeholder perceptions related to the problem and place this into the more generic innovation system in which a specific agricultural problem is embedded (Schut, et al., 2016). More easily said, a successful agricultural innovation depends on how well the innovation fits within a society. Innovations are challenged by a dominant interconnected regime of policies, markets, cultures, industry, technology and science (Geels F. W., 2005). Only the innovation that is capable of

competing with this regime has a chance to become integrated into society. Connecting this seemingly unconnected regime are institutions: cognitive, normative and mental models that orient human behaviour (Hounkonnou, et al., 2012). An institution influences behaviour, perception and choices and often operates across dimensions. To give an example; the performance contract influences behaviour strongly because the chain of accountability to superiors does not include (bottom up) feedback from farmers. Policies are therefor implemented without consulting farmers about their needs. The risk of this kind of interaction between farmers and authorities is a system failure that seriously limits the potential impact in terms of adoption of an innovation (Klein Woolthuis, Lankhuizen, & Gilsing, 2005).

The agricultural systems approach (AIS) aims to understand interactions between actors and institutions to uncover mechanisms that lead to successful innovation (Klerkx, 2010). Research organizations that specialized in Agricultural Research & Development find themselves right in the middle of such a complex agricultural innovation system. The role of research within such a system is diverse. Researchers can play a role as producers, brokers, packagers and managers of knowledge. But in order to do this well within the AIS, the researcher is subject to formal and informal 'rules of the game' (Schut, van Paassen, Leeuwis, & Klerkx, 2013). These rules of the game stretch across biophysical, technological, social–cultural, economic, institutional and political dimensions and across farm, village, district, regional and national levels. Interaction and negotiations between stakeholders within those dimensions and levels shape the innovation process, constrains and enables space for solutions or problem orientation. Researchers are one stakeholder among many in the multi-dimensional and multi-level innovation environment. And that environment determines when, how and what research and contribute effectively (Schut, van Paassen, Leeuwis, & Klerkx, 2013).

When, how and what researchers can contribute to the innovation process is strongly influenced by institutions. As mentioned before, institutions influence behaviour, perception and choices of stakeholders. This has an effect on the opportunities for researchers to function as knowledge producers and knowledge brokers in multi-stakeholder processes. In order to create space for new ideas coming from researchers in an innovation or development process, institutional innovation can be necessary. The Consortium for Improving Agriculture-based Livelihoods in Central Africa (CIALCA) tries to overcome institutional constraints to innovative ideas by engaging in interaction on a technical and administrative scale. CIALCA is a consortium that combines the expertise of research organisations to bridge the knowledge gap between farmers, public/private extension workers, scientists and policymakers by various strategies to shape credible, legitimate and relevant research. Engaging in institutional innovation is challenging. Institutions are enduring and resistant to change because of their embedding in society and the system. Institutional innovation is an incremental process and takes many years. This is challenged by funding organizations that don't provide enough time to actually engage in supporting institutional innovation (Schut, van Paassen, Leeuwis, & Klerkx, 2013). Institutional innovation requires a longer commitment then the average duration of 3-4 years for a research project (Huggins, 2014). It is also difficult to measure

institutional innovation and provide proof of a return on investment to funders. Lastly, institutional innovation can easily be seen as political. Advocating an approach to development that is different from current approach can be easily dismissed or seen as criticism.

Overcoming these challenges is part of the lack of knowledge about how researchers can best support institutional innovation. By studying institutions researchers can learn how to strengthen their position of as innovation managers, knowledge producers and knowledge brokers. Studying institutions helps to map networks of interaction between actors. It can help to make predictions about the impact of disruption in an agricultural system. It provides insight in the quest legitimacy for an innovation and creates awareness amongst stakeholders about their interdependency in an innovation process. Learning how to support institutional innovation can break established mental models of behaviour, perception and choices, hereby generating a more open and tolerant environment for innovation with more opportunities for change and a reduced risk on system failures. Because disruption precedes substitution (Geels F. , 2011), this study assumes that institutions change when there is a loss of human and resource capacity that enact and sustain the institution. This thesis investigates the assumption by comparing two cases where researchers of CIALCA engaged in institutional innovation. This comparative case study involves the analysis and synthesis of the similarities, differences and patterns across two cases that share a common focus or goal (Vaus, 2001). In this research the common goal is CIALCA's efforts in supporting institutional innovation. Key evaluation questions are: 1) how did CIALCA facilitate or support institutional innovation 2) what strategies were used to make changes in the actor and resource capacity of institutions and 3) what were drivers that cause a loss in capacity of the old institution. By examining the functioning of actors, rules, resources and time as drivers in an institutional innovation process we can learn how researchers can facilitate and support these. The research uses qualitative data from interviews and workshops collected from various actors and stakeholders that were involved in the innovation process of the two selected cases.

This thesis addresses the following general research question:

"What roles or functions can research organizations fulfill in supporting institutional innovation processes in Agricultural Innovation Systems?

The following sub questions are composed to help answer the general research question:

1. *What are institutional innovation processes that were triggered by CIALCA in Rwanda?*
2. *What are the key characteristics (actors, rules, resources and time) of these cases of institutional innovation?*
3. *What was the role of CIALCA during different phases of the innovation process?*

4. *What generic lessons can be learned that can support institutional innovation through AR4D in other contexts?*

This report is structured as follows; first the key concepts for this research are explained in a conceptual framework. In chapter 2 the methodology explains the method for selecting two relevant cases of institutional innovation and the method of data collection. The analytical framework of chapter 3 explains how data was interpreted and analysed in order to understand the key-characteristic supporting and facilitating institutional innovation. Chapter 4 gives the results of the data collection, presented as descriptions of the two selected cases of agricultural innovation and the role of CIALCA to facilitate institutional innovation. In the discussion in chapter 5, the two cases are compared to analyse their similarities and differences. Chapter 6 concludes this research with an answer to the general research question, study limitations and recommendations for further research.

2. Conceptual framework

In the context of Agricultural Research & Development (AR4D) in Rwanda there is a lack of knowledge about how research and researchers can best support institutional innovation. This is a problem, because researchers who try to contribute to the agricultural development process in Rwanda find their input being constraint by institutions. Researchers would need to learn how to facilitate or support change in institutions to generate a more open and tolerant environment for innovation with more opportunities for new ideas and a reduced risk on system failures. To understand what roles or functions research organizations can fulfil in supporting institutional innovation processes, we need to understand what roles institutions play and what roles researchers play in agricultural innovation systems. The multi-level perspective on transitions explains the functioning of a system and how it responds to innovation and change (Geels F. , 2004). This midrange theory incorporates institutional theory as a factor of stability that makes the system resistant to change (Geels F. , 2004) (DiMaggio & Powell, 1991). System research also answers questions how institutions shape an innovation process. Furthermore it explains the role of researchers in the innovation process.

2.1 What are institutions and why do they endure?

In social science, institutions are defined as a social phenomenon. They are often described as 'rules of the game', where the word 'game' refers to any kind of interaction process between actors. Institutions fulfil an important coordinating and structuring function within political, societal and organizational processes (Kite, 2013). Actors use it to orient their behaviour in interaction which reduces feelings of uncertainty and helps to create a kind of stability of activities overall (Leeuwis, 2004) (Geels F. , 2004) (North, 2004). The central building blocks of an institution are regulative, normative and cognitive rules. These rules are responsible for the coordinating and structuring nature of institutions. Rules are the social mechanism that allow institutions to exist: 1) it pushes compliance by, 2) deploying coercive, normative pressure and mimetic mechanisms, 3) it applies a form of social logic to become socially enforced, endorsed and reproduced and, 4) it forms the basis of legitimacy for activities (Geels F. , 2004). Table 1 gives an overview of the three kinds of rules and their varying emphasis. The table shows how actors use rules (examples, logic) but are also influenced by it (compliance, mechanisms, legitimacy). This is defining feature of institutions. Institutions constrain actors' independent development of new ideas. Actors are conditioned in their interaction with other actors. Interaction forms the starting point for actors to contain, diffuse or mediate their ideas, but this interaction is constraint by regulative, normative and cognitive rules. Actors orient their behaviour within the 'boundaries' of these rules. This influences ideas but also influences networks, education, communication, partnerships and collaborations. This fuels group thinking and generates the formation of regimes of similar ideas, identities and structures. This is called institutional

isomorphism and is the reason behind institutional endurance and institutional resistance to change (DiMaggio & Powell, 1991).

The technocratic and top down approach to agricultural innovation is an example of institutional isomorphism. Actors in the Rwanda government implement regulative rules to embed technical solutions to agricultural problems. These governmental actors expect farmers to adopt these technical solutions because of normative rules like role-expectations that give the government the authority to design agricultural development. Lastly, cognitive rules define the problem agenda (an example of this is the idea that technical solutions will solve poverty) and gives priority to technology solutions above other options. This example shows how regulative, normative and cognitive rules are interlinked. One cannot change one of the rules without changing the others (Geels F. , 2004). This makes institutional innovation such a challenge

Table 1:
Varying emphasis: three kinds of rules (Geels F., 2004)

	Regulative	Normative	Cognitive
Examples	Formal rules, laws, sanctions, incentive structures, reward and cost structures, governance systems, powers systems protocols, standards, procedures	Values, norms, role expectations, authority systems, duty, codes of conduct	Priorities, problem agendas, beliefs, bodies of knowledge (paradigms), models of reality, categories, classifications, jargon/language, search heuristics
Basis of compliance	Expedience	Social obligation	Taken for granted
Mechanisms Logic	Coercive Instrumental (creating stability)	Normative pressure Appropriateness (being part of a group. 'how we do things'.)	Mimetic (learning, imitation) Orthodoxy (shared ideas, concepts)
Basis of legitimacy	Legally sectioned	Morally governed	Culturally supported, conceptually correct

2.2 Why, how and when do institutions change?

Institutions are regulative, normative and cognitive rules that coordinate and structure activities. They are self-activating through social mechanism of coercive, normative and mimetic isomorphism (DiMaggio & Powell, 1991). This helps institutions to achieve stability and characterized them and social phenomena that are resistant to change. They shape innovation processes by defining what is seen as legitimacy, credible and relevant ideas, activities and interactions. Institutions change when the self-

activating system, causing institutional isomorphism, is breached. In other words: the rules of the game need to be broken or altered. How does this happen?

It is important to understand that institutional changes can have different time frames. Institutional change can be the result of a disruptive shock to the system. In Rwanda, an example of such a shock is the genocide of 1994. A shock of this magnitude causes a society to radically change their ideas about regulative, normative and cognitive rules (Clemens & Cook, 1999). For example, Article 54 of the Rwandan constitution prohibits political organizations from basing themselves on race, ethnic group, tribe, clan, region, gender, religion or any other division, which may give rise to discrimination (Government of Rwanda, 2003). In most cases though, institutional change is the result of an incremental and evolutionary process (Geels F. , 2004). An incremental process is the result of perceived institutional constraints by actors in an innovation process. Constraining institutions ignore actions, neglect opportunities and obstruct patterns of actions (Hounkonnou, et al., 2012). These actors will start to try and change the cognitive, normative and regulative rules. However, actors who perceive the institution as constitutive balance the process. They feel that the institution guides actions, defines opportunities and helps to facilitate patterns of action. This process is usually packaged within suggestions for policy or technical change. Suggestions for policy or technical change reveal constraining or constitutive institutional environment. However, you cannot change regulative rules without changing normative or cognitive rules (Geels F. , 2004). Institutions change when the actors enacting it and the resources (interaction) sustaining it loose their capacity (Clemens & Cook, 1999). Human capacities in this study refers to a group of people that share the same or a similar goal or vision for a specific problem and actively try to improve their abilities to achieve measurable and sustainable results (United Nations, 2006). Resource capacity in this study refers to collaboration, partnerships, communication, education and networks (Klein Woolthuis, Lankhuizen, & Gilsing, 2005). Capacity building means that the group of actors with the same goal or vision grows, hereby increasing the pressure for institutional change. Resources allow for mediation, diffusion and containment of ideas via interactions aimed at joint learning, knowledge sharing, and negotiation. Capacity building via actors and resources may change institutional rules. However, it is important to understand that institutional change is not a linear process. It is the result of trial and error where institutions shape the credibility, relevance and legitimacy of new activities, and ideas (Schut, van Paassen, Leeuwis, & Klerkx, 2013) (Geels F. , 2004). Outcomes are often also starting points for new potential changes (Hounkonnou, et al., 2012). Regulative and/or technical changes often lead to new questions or new perceptions of institutional constraint. Institutional innovation is therefore an on-going process of perceived legitimacy.

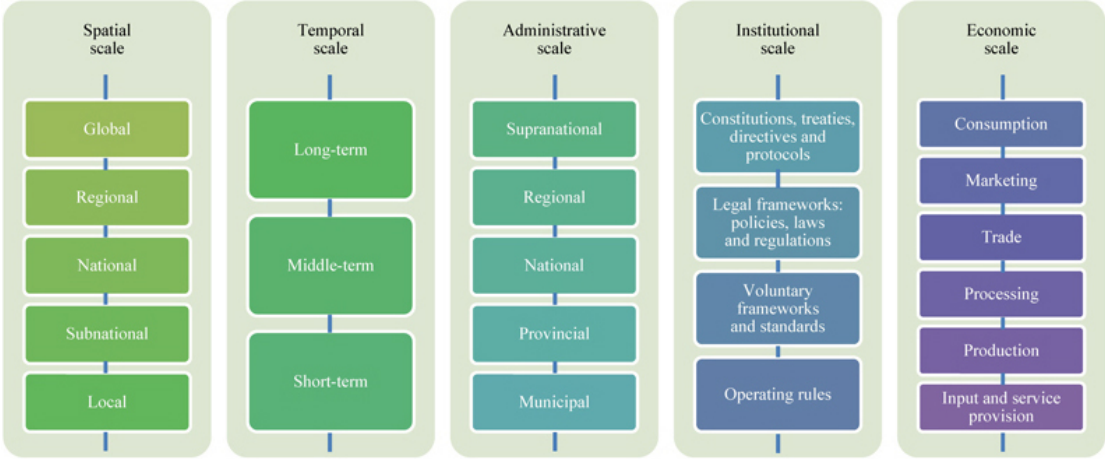
Building on the definitions above, this research defines institutional change as: *a regulative, normative and cognitive system of rules, enacted, embedded and sustained by interdependent actors, rules and resources. It coordinates and structure human behaviour and (inter) action. The system evolves over time within the organizational environment through an on-going quest of legitimacy for a regulative and/or technical change* (Geels F. , 2004) (DiMaggio & Powell, 1991) (Clemens & Cook, 1999) (Leeuwis, 2004).

2.3 How do institutions shape agricultural innovation processes?

Institutions shape an agricultural innovation process by conditioning multi-stakeholder processes and interaction across the different dimensions, scales and level of an agricultural system. Institutional rules affect the behaviour of actors and interaction amongst actors (resources) in an agricultural innovation process. This affects the containment, diffusion and mediation of idea across the system, creating specialised social groups that have their own objectives, needs, organizational structures and perceptions of a problem. Within an agricultural innovation system there are eight specialized groups: farmers, input industries, processors, traders, researchers, extensionists, government officials, and civil society organizations (Klerkx, 2010). Groups tend to act strategically to achieve objectives rather then collaborative (Schut, van Paassen, Leeuwis, & Klerkx, 2013). This also affects how ideas and decisions about a problem and solution move across the system. Furthermore, actors are embedded in different dimensions, across different levels and scales. Actors from a specific dimension focus on a specific aspect of a problem and this generates different believes and knowledge and perceptions. Dimensions also interact; the socio-cultural dimension frequently influences the political dimension with believes or language that become part of political policies. Institutions that interact across dimensions are stronger and more enduring then institutions without interactions across dimensions. For example: cognitive, normative and regulative rules in Rwanda allow the government to make decisions about how farmers should manage their farms. The government will invite an agronomist to advise on which crops will give the best yield. The agronomist will look at this question with a biophysical lens while the government might look at this question with an economic lens. Different lenses generate different data and will have a different effect upon farmers (Mackay, Kenny, & Chappell, 2010). To complicate matters even more, institutions have different meaning across scales and levels. International agreements on climate change will affect the national agenda and priorities, even though people on local levels might have different needs. Actors interact, but when this interaction is not adequately managed across dimensions, levels and scales, there is an increased risk of system failure (Klein Woolthuis, Lankhuizen, & Gilsing, 2005).

Figure 1 shows the five defined scales and their levels that affect (agricultural) innovation (Schut, Leeuwis & Paassen, 2013). In agricultural innovation, spatial, temporal and administrative scales play the most important role (Schut, van Paassen, Leeuwis, & Klerkx, 2013). The spatial and administrative scales are strongly interdepended. Decisions about cropping techniques for agricultural development at a national administrative level will have an effect upon operating rules on a municipal level. Also the temporal scale plays an important role in an institutional innovation process. Research acknowledges that institutional innovation is a long-term process. However, funding organizations are used to working with shorter time frames for research projects (Schut, van Paassen, Leeuwis, & Klerkx, 2013). This makes it difficult for researchers to fully engage in institutional innovation.

Figure 1:
Examples of scales and levels (Schut, Leeuwis, & Paassen, 2013)



The explanation of how institutions shape agricultural innovation process can be illustrated the case of Rwanda's SPTA policy where the approach to agricultural development is technocratic and top down in nature. Policy-making is an elite driven affair (Ansoms A. , 2009). Policy-makers have normative rules about role expectations between farmers and the government. They feel a social obligation to lead farmers to an agricultural transition. They also have cognitive rules about development priorities and problems. The policy-makers embed the normative and cognitive rules in regulative rules like policies and a governance structure. Agricultural development is governed in a top-down manner in Rwanda. This top-down institution affect decision-making that starts at a national scale and trickles downward to provincial and municipal scales. The institution coordinates and structures these activities for the farmers on a spatial scale at a local level with input and service provision, production guidelines like monocropping. This further affect processing and trade on an economic scale.

Because institutions try to stabilize interaction, it limits the space for change in an innovation process. Institutional rule-structures, affect actors and resources. It conditions interaction that allows for the containment, diffusion and mediation of ideas from actors across dimensions, scales and levels, limiting experimentation, negotiations and learning.

2.4 How can researchers support institutional innovation?

Institutions in innovation systems strongly influence the behavior of actors in interaction but actors also influence institutions. Institutions reduce uncertainty in interaction and coordinative activities, this means institutions are shaped by interactions. Interaction is therefore the starting point for change where actors can contain, diffuse and mediate ideas, even though institutions will put pressure upon the independent development of interaction and ideas. Researchers are traditionally knowledge producers that add new insights to an innovation process. They have experienced how their contribution is affected by institutions and innovation processes. Institutions strongly affect the space

for the containment, diffusion and mediation of research because it conditioned the interactions between researchers and other actors. These so called boundary arrangements define responsibilities and tasks (Schut, van Paassen, Leeuwis, & Klerkx, 2013). The researcher-stakeholder interface presented in table 2 shows different types of relationships researcher have with other actors in the innovation system.

Table 2:
Boundary arrangement at research-stakeholder interface (Schut, van Paassen, Leeuwis, & Klerkx, 2013)

Boundary arrangement	Description
Independent research	Research is independent of stakeholder or political interests. Research is not concerned with how research findings are mobilized and used by stakeholders in policy and innovation processes.
Research steers stakeholders	Research actively seeks to persuade stakeholders to select a specific solution for problem or a certain way of organizing policy or innovation process.
Informative relationship	Dissemination of information on e.g. policy content and process. Research and stakeholders inform one another in a supply-oriented fashion
Advisory relationship	Research and stakeholders operate in their own separate domains, but research provides advice to stakeholders, and stakeholders can advise research about relevance of research questions.
Exchange relationship	Research acknowledges that stakeholders have specific needs and questions, and proactively seeks to reconcile demand and supply. Research and stakeholders interact on research demands and exchange information.
Co-learning relationship	Co-production of research. Researchers and stakeholders engage in a joint learning relationship to produce stakeholder-relevant research. Research and stakeholders seek to complement each other.
Capacity building relationship	Research builds capacity and seeks to strengthen position and capacity/skills of stakeholders in policy and innovation process. Stakeholders can also empower research by providing research with a platform to mobilize research findings.
Selective use of research	Stakeholders use research opportunistically, selectively and strategically to defend their interests and pursue their goals. Research has little influence on how findings are interpreted, mobilized and used by stakeholders.
Stakeholders steer research	Stakeholders influence and determine research agenda setting, how research is conducted and/or used. Degree to which researchers can participate in, or contribute to, policy and innovation process is controlled by stakeholders

In Rwanda, the research-government interface is often limited to answering technical questions on agricultural problems (Reyntjes, 2010). The boundary arrangement is therefore often defined as an informative or advisory relationship. This kind of relationship offers limited space for research that does not deal with technical questions. These are deemed irrelevant. Researchers find their research being perceived less relevant, legitimate or credible if it doesn't align with the objectives and needs of the stakeholder defined by the established relationship (Schut, van Paassen, Leeuwis, & Klerkx, 2013). In an innovation process, boundary arrangements are path dependent meaning that a previous relationship influences the feasibility and credibility of future relationships (Schut, van Paassen, Leeuwis, & Klerkx, 2013). The mediation of ideas is affected by phases of innovation process. Research must align with the phases in an innovation process. The relevance of research about problem orientation is no longer perceived relevant when the innovation process is in a solution phase (Schut, van Paassen, Leeuwis, & Klerkx, 2013).

Besides interaction, the innovation system approach acknowledges that existing infrastructures, assets and actors' capabilities and resources also influence an innovation process. Klein Woolthuis (2005) defines four categories of innovation systems (see table 3). Two of the categories are assigned to interaction and institutions, the components of institutional endurance and change. The other two categories deal with physical resources, which are different from the (social) resources necessary for institutional innovation. They are however of major importance in an innovation system. When the categories are not adequately aligned or connected it can result in a low adoption-rate or rejection of innovation or it can cause undesired effects as result of disruption (Klein Woolthuis, Lankhuizen, & Gilsing, 2005). The institutions mentioned in table 3 relate to the regulative, normative and cognitive rules defined by Geels (2004). They are less detailed, because the list mostly focuses on regulative rules. Normative and cognitive rules are mentioned in general terms.

Table 3:

Categories of innovation systems (Klein Woolthuis, Lankhuizen, & Gilsing, 2005)

Infrastructure and assets	Interaction and collaborations
- Roads, irrigation schemes, agricultural inputs distribution - Telecommunication - Financial infrastructure - Assets, such as vehicles for transport workers or agricultural produce. - Agricultural machines - Agricultural inputs/ seeds	- Multi-stakeholder interaction for learning and problem-solving - Systematic development and sharing of knowledge and information (strategic intelligence) - Public-private partnerships - Existence and strength of networks (too strong or too weak) - Existence of representative bodies (e.g. farmers association) - Power-dynamics and politics
Institutions	**Capabilities and resources**
- Agricultural policies/laws	- Agricultural entrepreneurship,

- Regulation incentives - (Food) quality standards - M&E networks - Organizational mandates - Market (access) - Trade agreements - Social cultural norms/values - Informal rules of the game - Lobby - Resistance to change	- Availability of labour - Access to knowledge and education - Availability of financial resources - Access to credit/ microfinances - Capacity to mobilise funds

In contrast with Klein Woolthuis, Schut et. al. (2013) has defined more specific roles for researchers in interaction and collaboration for developing an enabling environment for innovation. In his research, he assigns the roles of knowledge and innovation managers to researchers. Researchers as knowledge producers are directly influenced by a limited or conditioned flow of ideas through the system. It affects their contribution to innovation processes. Not only technical ideas are constraint, but also ideas about how agricultural development should be managed. To overcome this problem, researchers can take up roles as knowledge managers and innovation managers. Table 4 shows these knowledge- and innovation management roles for researchers. Production, brokering and packing of knowledge are strategies that may challenge traditional mental models. Innovation management enables and manages interaction allowing for a better containment, diffusion and mediation of scientific knowledge. The two roles are reinforcing. Innovation management can give instructions to knowledge management about relevant, legitimate and credible research and vice versa. The role of innovation managers can be illustrated with a lobbying case. Academics changed some of the regulative rules about monocropping and intercropping despite the government's preference for monocropping by actively lobbying and relying on extensive field experience (Damme, Ansoms, & Baret, 2013).

Table 4:
Example of knowledge and innovation management roles for researchers (Schut, van Paassen, Leeuwis, & Klerkx, 2013)

Knowledge management roles	Innovation management roles
Knowledge production: • Generate and mobilize new and existing knowledge and insights	Manage boundary arrangements at multiple research–stakeholder interfaces
Knowledge brokerage: • Inform: transfer and disseminate content • Consult: mobilize and provide expertise • Match make: connect experts and actor/stakeholder groups • Engage: involve stakeholders in, e.g. policy debates • Collaborate: facilitate collaboration at	Develop adaptive capacity in policy and innovation processes (embedding researchers in the system) Develop enabling environment to facilitate continuous stakeholder learning, e.g. fundraising, lobbying or criticizing political agendas Address institutional constraints and structural

multiple stakeholder–stakeholder interfaces	power asymmetries
• Capacity building: develop process architecture and joint knowledge production and learning	Enhance reflexive monitoring and evaluation, and strategic adjustment of policy and innovation process
Knowledge packaging: • Enhance accessibility of research for different stakeholder groups • Develop innovative knowledge packages	Promote interdisciplinary research to understand the interaction of institutions across dimensions, levels and scale.

Managing knowledge and interaction is the starting point for institutional innovation. It allows actors to learn, experiment, negotiate and collaborate, hereby exploring institutional constraints together. Innovation and knowledge management has the potential to facilitate resources like collaborations, partnerships, communication, education and networks. A stronger resource capacity may increase the chance that actors enacting an old institution lose its capacity because of an access flow of new ideas and insights. When actors start to enact the new ideas, it slowly alters an institution by process of learning, mimicking, normative pressure or coercion. The key characteristic for institutional innovation is facilitating interaction that allows for an access flow of ideas towards actors, who then can engage in a process of containing, diffusion or mediating those ideas. This process is path dependent, responding to decisions made in the past, like boundary arrangements or the problem orienting or problem solution phase of an innovation process.

3. Methodology and analytical framework

Since 2006, the Consortium for Improving Agriculture-based Livelihoods in Central Africa (CIALCA) engaged in integrated and applied system research in Rwanda, Burundi and DRC Congo to support agricultural innovation (CIALCA, 2015). CIALCA is a research for development partnership that combines the expertise of two (formerly three) agricultural research organizations (CIALCA, 2016). CIALCA was set up with a purpose to strengthen interaction between important actors in an agricultural innovation process and stimulate the flow of ideas via capacity building, joint learning and adaptive management (CIALCA, 2015). By working with partners from different levels, across dimensions and scales CIALCA helps to align activities in the agricultural innovation system and enable an environment for innovation (CIALCA, 2015).

This research focuses on the institutional environment for Agricultural Research & Development in Rwanda and CIALCA's experiences in facilitating institutional innovation within this context. Two cases of agricultural innovation in which CIALCA was involved will be selected for a comparative analysis. These cases of agricultural innovation will be selected for representing institutional challenges. The analysis will involve a description of institutional challenges and CIALCA's strategy derived from qualitative data like observations and words. The cases will be compared to analyze the similarities and differences between the cases and explore under which conditions CIALCA's strategies of applied systems research, knowledge management and innovation management were successful in generating alterations in the actor- and resource-capacity of institutions. To reconstruct and analyze the cases, the qualitative data was collected during fieldwork in Rwanda. Data collection for this research was divided into three phases. In phase one, data for the first case was collected from semi-structured interviews. In phase 2, a participatory workshop with stakeholders was organized. In phase tree, data for both cases was collected from case documentation. Both cases were complimented with in-depth interviews with CIALCA researchers.

3.1 Methods of data collection

The aim of the first phase of data collection was to select two relevant cases of institutional innovation. CIALCA's development partners were interviewed and asked about cases of agricultural innovation that required institutional innovation. The development partners were selected using purposive sampling and invited for interviewing via email. The development partners who were interviewed were farmers, governmental actors from RAB (Rwanda Agricultural Board) and CIALCA researchers. Other development partners, MINAGRI, extension services and the private sector, were unavailable for interviewing. An interpreter was used during the interviews with the farmers. The aim of the semi-structured interviews was to explore the work of CIALCA in the context of AR4D in Rwanda and institutional innovation. The interview consisted of 5 questions show in table 5. The complete interview form can be found in appendix A.

In total 8 semi-structured interviews with development partners were conducted.

A malfunctioning voice recorder caused some trouble and it was decided to write notes during all the interviews to remain consistent. From the interviews a case would be selected based on the frequency it was mentioned. CIALCA researchers selected the second case. This was done in consultation with the researchers via a meeting.

Table 5:
Phase 1 of data collection; questions for semi-structured interviews with CIALCA development partners for case selection.

Interview questions
1. Can you describe the work of CIALCA in Rwanda to me?
2. How did CIALCA contribute to agricultural development in Rwanda?
3. What kind of innovations did CIALCA suggest?
4. How did they manage these innovations (in the light of uncertainty, differentiating objectives, organizational structures or other (institutional) constraints)
5. What do you think is essential when trying to manage institutional innovation?

The purpose of the workshop of phase 2 was to achieve a deeper understanding of the case selected in phase 1. The point of departure for the participatory assessment workshop was; reconstruct the agricultural and institutional innovation process of a case and to evaluate the role and influence of knowledge management and innovation management by CIALCA. The participants of the workshop represent the CIALCA's development partners: farmers, extensionists, private sector, government (MINAGRI) and researchers. The participants were selected using purposive sampling. At the start of the workshop the participants were divided into stakeholder groups based on professional representation. During the exercises participants were free to discuss and ask questions to other groups. The workshop was organized on September 16th 2015 in which a total of 15 representatives of five different stakeholder groups participated (farmers, extensionists, private sector, government (MINAGRI) and research). To allow for a smooth workshop planning, the farmers were invited separately. They did the same workshop with an interpreter on September 17th 2015.

The exercises of the workshop were designed explore the role of researchers (CIALCA) as knowledge/innovation managers. An overview of the exercises can be found in table 6. To structure the observations of participants, a timeline was used. Placing observations in time gives insight the problem orientation or problem solution phase of the process. The timeline will reveal where, when and why change happened. It also reveals the speed of the process (radical or incremental).

Table 6:
Phase 2 of data collection; workshop with CIALCA development partners for a deeper understanding of the case, taken from Rapid Appraisal of Agricultural System (RAAIS) tool (Schut M. , et al., 2015).

Workshop exercises
1. Identify innovation steps: • Exercise 1: Stakeholders individually identify the 5 innovation steps they believed contributed to the innovation process. • Exercise 2: Identify and rank innovations steps as experienced by each

stakeholder group.

2. Deeper analysis of the innovation steps:
    - Exercise 3: Categorizing the innovation steps in the categories of innovation systems: infrastructure and assets, institutions, interaction and collaboration capabilities and resources.
    - Exercise 4: Innovation for whom? An assessment of perceived relevance, credibility and legitimacy of the innovation steps.
3. Context of time:
    - Exercises 5: Stakeholders create a timeline and place the innovation steps on the timeline towards institutional innovation and the adoption/agreement of the case. Participants can add other factors that were important in the institutional innovation process if they can remember.

Phase 3 of data collection contained in-depth interviews with CIALCA researchers and the collection of documentation. During the in-depth interviews with CIALCA researchers were asked to compare the two selected cases. In total 3 in-depth interviews with CIALCA researchers were held. The interviewees were selected according to their expertise and involvement in the projects. The interviewees are made anonymous by codifying them: CIALCA_researcher(number). In this research, references towards the interviews are noted via the codified names. The in-depth interview questions (see table 7) focused on experiences, feelings and thoughts about achieving legitimacy for ideas based on scientific research and the role of knowledge management and innovation management in institutional innovation processes. Innovation is a human process so qualitative data from experiences and interpretations of stakeholders will help in the reconstruction innovation process and innovation environment. The interviews were recorded and later transcribed. The transcribed interviews can be found in appendix C.

Because interviews and the workshop rely on memories, it can leave out important details like dates of interactions, partners presents or issues raised, therefor both cases were complimented with all project documentation from CIALCA. These documents (annual reports, technical reports, internal publications and formal publications) were collected from the database of IITA and CIALCA and via Scopus. Other documents from other stakeholders (USAID, MINAGRI, IITA) were used to verify the information in the CIALCA documents. These other documentation (annual reports and newsletters) collected from stakeholders involved in the case by downloading the documents from their own websites. Reports document activities and evaluations, which give a good overview of ideas, behaviour perception and choices during the process. The documents allowed for a deeper analysis of the institutional environment because they were written at a certain point in time. This way, documentation functioned as a more reliable source of data in case memories from stakeholders would fail. Furthermore, scientific articles were used to help understand both of the cases selected and put them into context.

Table 7:

Phase 3 of data collection; questions for in-depth interviews with CIALCA researchers

Interview questions
1. How did CIALCA achieve legitimacy for their innovation of banana-coffee intercropping?
2. Did CIALCA actively influence the innovations that are part of the Crop Intensification Program? If so, how did they do that?
3. What is similar in the process of innovation on an institutional level between the cases of Banana-coffee intercropping and the National Crop intensification program (from CIALCA's point of view).
4. What is different in the process of innovation on an institutional level between the cases of Banana-coffee intercropping and the National Crop intensification program (from CIALCA's point of view).
5. What did the merge of RADA & ISAR into RAB mean for CIALCA (on a technical and institutional level)?

3.2 Analytical framework

On the basis of an analysis of institutional endurance and institutional change there are four analytical concepts that can be used by a researcher to make sense of what is happening in a process of institutional innovation; actors, resources, rules and time. These analytical principles can be divided into passive and active enablers of change. Active enablers of institutional change are actors and resources. They enact and sustain new cognitive and normative rules. Passive enablers are rules and time. Time affects the decision taken at different phases of a project. A solution is a momentum that was captured in (in) formal agreements, policy documents or other documents. It may be very hard to change one of these solutions in a later phase of the project (Schut, Leeuwis, & Van Paassen, 2010). Rules can form a constitutive environment for certain ideas. Together, time and rules can create windows of opportunity for new ideas. Within the current study, especially the active enablers (actors and resources) have been used to perform the analysis because the relation with innovation and knowledge management strategies.

Actors as active enablers of institutional change points to the role actors play in enacting cognitive, normative and regulative rules. This role is influenced by the tendency of actors to form groups (DiMaggio & Powell, 1991). The diversity of actors in an innovation process gives clues about the diversity and acceptance of new ideas. Homogeneous groups tend to be less innovative then heterogeneous groups (Clemens & Cook, 1999). Actors belonging to specific specialized social group; like farmers or researchers generally form homogenous groups. These groups influence the innovation processes but are also influenced by them with specific and group characteristic objectives, needs, perceptions, knowledge motivation, expertise. Depending on actor capacity these groups have power or authority.

Groups are not static but dynamic. The capacity of ideas shared amongst group member's changes (DiMaggio P. , 1997). This change is determined by the availability of resources (Clemens & Cook, 1999). Resources can function as active enabler of institutional innovation because it sustains the flow of ideas about cognitive, normative and regulative rules. Resources are based upon their capability to mobilize interaction and the flow of idea between actors. They are defined as; networks, collaborations, partnerships, communication, participation, learning, education, training, workshop, platforms and (material and financial) funds.

Table 8:

Overview of coding words for documentation analysis

Enablers	Words
Actors	Stakeholders, actors, capacity (capacity building), power, objective, need, perceptions, motivation, capabilities, expertise, knowledge, authority
Resources	Network, collaboration, funds, funding, participation, partnership, communication, interaction, learning, education, associations, sharing, education, training, workshop, platform, joint
Rules	Rules, laws, sanctions, incentives, governance systems, power, protocols, procedures, values, norms, role expectations, authority, duty, codes of conduct, priorities, beliefs, paradigms, mental model, standards, monitoring/evaluation, agreements
Time	Time, agenda, priority, dates (day, months and years), phase, duration, temporal, planning (long-tem, midterm, short-term), past, present, future

Data from phase 1, the semi-structured interview with development partners, were analysed by counting the frequency of mentioning a specific case. The interviews were also used in constructing the case using the method of coding (see able 8).

The data generated from the workshop in phase 2 was analysed three different methods. Ranking the different steps mentioned by stakeholders will give a top 5 of most important steps in the institutional innovation process of the case. This will prioritize certain steps over other steps as playing a more important role. Next, these steps will be put into categories of innovation systems (Klein Woolthuis, Lankhuizen, & Gilsing, 2005). The categories will be related to the analytical concepts actors, resources and rules. Lastly the analytical concept of time will be understood by letting workshop participants construct a timeline. This timeline should give insight in the speed of process and the planning of activities. The timeframe selected for this research is 2000 until the end of 2015 based on the start of agricultural institutional developments in Rwanda in 2000, until the end of this research (November 2015) and the most up-to-date events. The results from the workshop can be found in appendix B.

The data collected from case documentation and in-depth interviews with CIALCA researchers was analysed using a coding method. Specific words related to both active and passive enablers of institutional innovation were searched for. Table 8 shows an overview of the words that were used. Furthermore, words were related to the analytical concept via a method of memoing. The method helps to write reflective notes about what the researcher is learning from the data. This is important when trying to reconstruct

and describes an institutional innovation process. The data from documentation is used to compliment the timeline of phase 2. Activities, vision, mission and organizational structure of CIALCA and CIALCA's development partners are described to reveal alignments or misalignments of interaction.

Finally, all the collected data is combined to reconstruct the cases following a timeline approach. It combines data from organisational models, the role of historic events (taken from documentation data) and interaction amongst CIALCA and development partners (taken from interviews, workshop and documentation data) over a period from 2000 until 2015.

Table 9 shows a summary of the data collection, sampling method, sample size, type of information gathered and data analysis strategy for this research.

Table 9:
Methods of data collection, sampling method and size and type of information gathered

Method for data collection	Sampling strategy	Sample size	Stakeholder groups targeted	Used in which phase of the research	Type of data	Data analysis strategy
Semi-structured interviews	Purposive sampling	8	Farmers, private sector, government, extension services, researchers, NGO's	Phase 1	Qualitative	Relating categories
Workshops	Purposive sampling	15	Farmers, private sector, government, extension services, researchers, NGO's	Phase 2	Qualitative and quantitative	Relating categories Prioritizing
In-depth interviews	Purposive sampling	3	CIALCA researchers	Phase 3	Qualitative	Transcribing Coding
Secondary data	Purposive sampling	n/a	n/a	Phase 3	Qualitative	Coding Memoing

4. Results

This chapter starts with a more detailed description of the objectives, activities and organizational structure of CIALCA. Next, two cases of agricultural innovation processes are reconstructed from the data collected in phase 1, 2 and 3. The role of CIALCA is analysed in different phases of the process focussing on active (actors, resources) and passive (rules, time) enablers of institutional innovation. The cases are reconstructed following a timeline approach. First the role of historic event that 'set the stage' is described. Then it looks at interaction amongst CIALCA and development partners over time over a period from 2000 to 2015. It summarized the events by describing possible impacts of CIALCA activities on the innovation process in relation to institutional innovation.

4.1 Description of the CIALCA organizational model

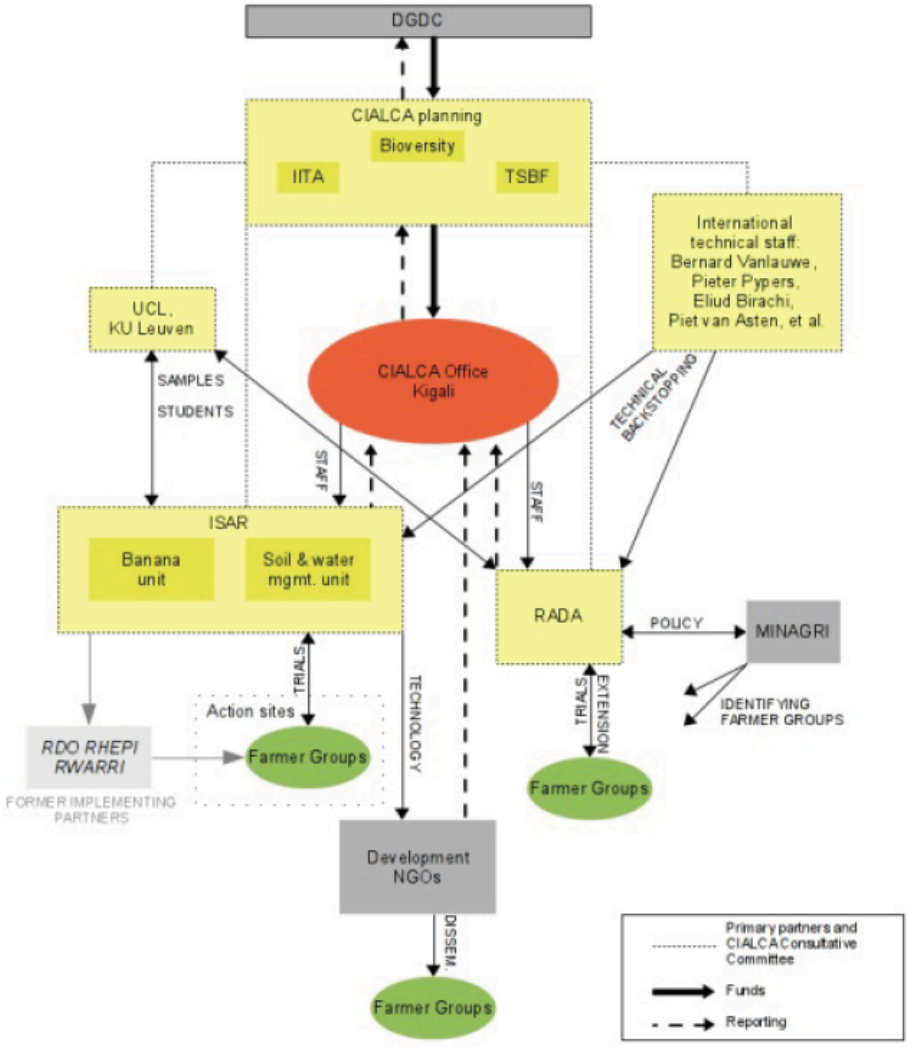
CIALCA is a research consortium that combines the expertise and networks of three research organizations: IITA, TSBF-CIAT, Bioversity International (formerly called INIBAP-IPGRI). A call for proposals of the Belgian Directorate General for Development Cooperation (DGDC) in April 2004 generated three separate but rather similar proposals. Because the proposed projects were similar in geographical location, national partner-institutes and activities, it was agreed to combine expertise to avoid technical and financial duplication at the national level. This idea was fully supported by DGDC and the National Agricultural Research Systems (NARS) of the concerned countries like Burundi, DR Congo and Rwanda. CIALCA is a consortium that operates at the both the administrative and technical level. This means that research is not purely technical oriented, but efforts to scale innovation from local to district or even national levels are made. CIALCA disseminates its 'products' (agricultural technologies and knowledge) through its development partners like farmers, NGO's and National Agricultural Research Systems.

In 2005, CIALCA I was research oriented and recruited staff for NARS. It focused on market access, nutritional and health status of rural households, and status of the natural resource base. During CIALCA I, these activities were directed towards banana-based and legume-based system. Activities were problem-oriented and directed at studying and describing a baseline for development. CIALCA II, was oriented around a common goal: '*to improve the livelihoods of agriculture-based communities in Central Africa by enhancing their capacity to access and efficiently use the resources needed to improve system productivity, resulting in a better income, nutrition, and environment*' (CIALCA, 2007). Activities were still research oriented. It looked at best-fit interventions at the household levels. Capacity building continued by supervising new MSc and PhD students. Efforts to activate impact pathways for achieving development impact at scale were made. This will elaborated on in the case studies. From 2014 and onwards, CIALCA operates under HumidTropics program where impact pathways are further defined for CIALCA products. The HumidTropics program deploys the integrated systems approach for sustainable intensification of agriculture production. Based on a Theory of Change for integrated

systems, CIALCA under HumidTropics works to facilitate participatory action across stakeholder groups to enhancing the capacity to innovate at farm, institutional and landscape levels. Also capacity building continues to be an important goal (CIALCA, 2015).

A hierarchical overview of the organisational structure of CIALCA is shows in Figure 2. The model shows the type of relations, flow of funds, flow of interaction between partners (Cox, 2011). Funding organisations are represented at the top, supporting CIALCA with financial resources. CIALCA in return reports back to funders. The flow of activities is represented with an arrow, showing one or two-way interaction flows. Interaction with NARS, ISAR and RAD (now merged into 'RAB'), is merely one-way. CIALCA recruits staff, suggesting a capacity-building relationship with NARS. IITA, Bioversity and TSBF-CIAT offer technical support to NARS. The technical support suggests advisory or informative relationship on a national level. CIALCA has a co-learning and capacity building relationship with the research organizations that form the consortium. Furthermore, CIALCA receives reports from farmer level from farm groups at actions sides via development NGO's.

Figure 2:
Organisational model of CIALCA in Rwanda (Cox, 2011)



4.2 Case 1: Rwanda's Crop Intensification Program

During the interviews it became clear that the answers of interviewees focussed merely on Rwanda's agricultural transformation as institutional innovation. The answers presented in table 10 describe how stakeholders relate CIALCA activities to this large-scale agricultural innovation and institutional innovation process. Farmers linked CIALCA to fertilizer training to the need for increased productivity that was linked to the Crop Intensification Program. Actors from National Agricultural Research Systems (NARS) and government officials link CIALCA with needs for technology and knowledge that followed the implementation of CIP. This program, a regulative innovation, was chosen for further analysis.

Table 10:
Phase 1: responses from semi-structured interviews with development partners.

The government was looking for new technologies, in the light of the Crop Intensification Program that they could upscale. – NARS researcher
What is essential in institutional innovation is to make sure that you have a good entry point in the national agenda (CIP)– Government official
The ministry started with a program on crop-intensification around 2009-2010 and needed seeds and fertilizers for a subsidized price. As it happened, CIALCA was a pioneer with knowledge in this field. - NARS researcher
CIALCA taught us to use fertilizers in combination with compost to boost productivity. This combination was an innovation – Farmer representative
CIALCA provided knowledge of cultivation by fertilizer recommendation allowing them to achieve a yield increase from 1 ton p. ha. into 4 tons p. ha. – Farmer representative
I knew CIALCA through RAB/ISAR. CIALCA was always involved. They worked on seed multiplication and we did trails on the use of fertilizers using 3 experimental plots. - Farmer representative

Overview of agricultural development in Rwanda.

Rwanda has embarked on a process of agricultural transformation guided by a formally documented vision of the Rwanda government. Vision 2020 supported an innovative process of institutional capacity building with the aim to reduce poverty, activating all administrative levels of the nation; from governmental officials at national level all the way down to the farmers community ('ubudehe') at cell level (Rwanda Goverance Board, 2016). An institution is build over time in a process capacity building of actors enacting the institution and resources sustain the institution. Institutional capacity building for agricultural transformation in Rwanda was triggered by a combination of interacting active and passive enablers that functioned as precursors for the design of the Crop Intensification Program. The four precursors for CIP are: 1) uncontrollable biophysical changes (drought), 2) incentives for regulation and 3) interaction on international, regional and national scale 4) mimetic isomorphism support by institutional arrangements.

The process of institutional capacity building started in 1999, when hunger

triggered a need for change. Workshop data reveals 'hunger' in Rwanda as the beginning of the institutional innovation process that later resulted in CIP. Participants connected hunger as a result of low crop production and poverty (see appendix B-1&B-2). Hunger was categorized as an incentive for regulative change. The year 1999 that was mentioned in relation to hunger in Rwanda coincides with an extreme drought in November that year (UN Office for the Coordination of Humanitarian Affairs, 1999). As a result of this disaster, Rwanda received food aid and new agricultural inputs like seeds and livestock. In 2000, the Government of Rwanda released the Vision 2020 (right after the drought) and strategies like EDPRS, National Agricultural Policy (NAP) and SPTA in 2001 and 2004 (Kathiresan, 2011). All these policies were aimed to reduce food insecurity (hunger) as a result of poverty. CIP became the main policy for agricultural modernization in SPTA in Rwanda (Cioffo, Ansoms, & Murison, 2016). Actors from other organizations supported Rwanda's agricultural vision. The ambitions of Rwanda's crop intensification process were in alignment with the agendas of international and regional development agencies. Interaction across these levels sustained certain ideas about how agricultural development should be governed. Under the valued term of 'good governance', a concept defined by the United Nations, Rwanda designed its policies to include the characteristics of good governance (United Nations, 2009) (MINAGRI, 2009) The crop intensification program connected with the Millennium Development Goals (MDG) of the United Nations. These goals were aimed to eradicate hunger and poverty in Africa (Kathiresan, 2011). Furthermore The World Bank, an influential funding organization in Rwanda, supported agricultural development that is "*facilitated, coordinates and supported by the state*" (Huggins, 2014) (Lee A. , 2015) (Cioffo, Ansoms, & Murison, 2016). On a regional (continental) level New Partnership for Africa's Development (NEPAD) emphasizes agriculture and the engine of growth and financially supports it (Cioffo, Ansoms, & Murison, 2016) (MINAGRI, 2009). Lastly, mimetic isomorphism, supported by the institutional partnerships and collaborations that were described earlier, shaped the Rwandan agricultural policies. The institution that is mimicked is the Asian Green Revolution. This 'so called' Green Revolution of Africa serves as an inspiration for Rwanda's agricultural policies. The Green Revolution mediates increased agricultural productivity through the facilitation of improved seeds, fertilizer and pesticides to boost agricultural production. Official CIP documents describe that '*poor accessibility to inputs by poor farmers*' is the consequence of low productivity. It believes that '*replication of such adoption of modern inputs*' (as in the Green Revolution) will increase agricultural productivity and food security in Rwanda (Kathiresan, 2011). The World Bank, Rockefeller Foundation and the Bill & Melinda Gates foundations advocate this approach. They support it financially and through partnerships like the Alliance for a Green Revolution in Africa (AGRA) (Cioffo, Ansoms, & Murison, 2016).

This institutional framework has an effect upon perception, decision and choices for agricultural innovation and the involvement of CIALCA research in CIP. CIALCA's interaction with the Crop Intensification Program need to be understood through the actors involved in enacting the program and formal agreements and policy documents (Vision 2020, EDPRS, NAP, SPTA) that came before CIP. These earlier agreements are hard to change and form a stable framework that coordinates the interaction between

actors and choices of actors. This institutional environment forms the 'stage for innovation' for NGO's like CIALCA to work in. Also CIALCA's organizational model will be used for the analysis because it defines the boundary relationships with NARS.

The role of CIALCA: Interaction between CIALCA and development partners and the involvement in the Crop Intensification Program

Drafting regulative rules for the transformation of the agricultural sector start as early as 2001 when the National Agricultural Policy (NAP) was outlined. NAP outlines major strategic issues in agricultural development like food security, economic growth and rural development of the Rwandan farmers. Later on, these strategic issues were translated into a Strategic Program for the Transformation of Agriculture. SPTA contains four programs; 1) intensification and development of sustainable productions systems, 2) support to the professionalization of agricultural producers, 3) promotion of specialty crops and agribusiness development and 4) institutional development. Four years later in 2005, several authorities were set up for the implementation of the above-mentioned policies and strategies. One of these authorities was The Rwanda Agricultural Development Authority (RADA). RADA was made responsible for the coordination and implementation of issues related to crop management and production (RADA, 2005). Besides an extension arm, MINAGRI reopened and reorganized the National Agricultural Research Institute (ISAR) (RADA, 2005). ISAR was responsible for agricultural research organization focused on poverty alleviation, food security and environmental sustainability (AMIS, 2015). Within this framework, ISAR and RADA were separated in terms of responsibilities and role expectation. They appeared not to work with an integrated systems approach. As one CIALCA researcher puts it:

"ISAR was completely not into extension and RADA was completely [not into research]..." (See appendix C; CIALCA_researcher1, in-depth interview phase 3)

RADA describes in a business plan how research has little value if not brought to farmers. In 2005, extension services were still weak and believed to be a reason why 'the Rwandan farmer has stayed conservative' (RADA, 2005). The divide between ISAR and RADA would be forcefully changed later on.

In Rwanda, an NGO's like CIALCA needs to register at the Rwanda Governance Board in order to work legitimately in the country. This form of enforced collaboration allows governmental authorities to monitor NGO's activities and involve them in governmental development plans (ICNL, 2016). CIALCA starts its collaboration with ISAR in 2006 (CIALCA, 2006). Joint research activities based on a capacity building and exchange relationship focus on banana and legume based systems. Both research organizations appear to align their agendas. The need for improved legume-seeds gives CIALCA the opportunity to contribute directly to formal legume programs led by ISAR. Together, the two organizations conducted research into high preforming bean and soybean varieties (CIALCA, 2008). RADA was quickly identified by CIALCA as potential 'client' and important actor in the agricultural innovation system because of its strong associations and activities with seed multiplication, market activities, training and

accreditation (CIALCA, 2008). In the same period of collaboration with ISAR and RADA, CIALCA starts successful actor- and resource capacity building activities; they recruit extension agronomists that are based with the coordinating extension partner RADA.

Positive feedback and results give motivation for CIALCA to write a proposal for CIALCA II. In October 15th 2007, ISAR agrees to continue collaboration with CIALCA for a period of four years (2008-2011) (CIALCA, 2007). The agreement between ISAR and CIALCA II was based around a mutual understanding of research needs at that time. CIALCA is trusted to "*make a significant contribution to support rural households to improve productivity and consequently health, income and environmental conditions*". ISAR believed that in returned it can contribute to CIALCA's '*overall goals*'. CIALCA also extends its partnership with RADA; space for "*recruiting highly qualified and motivated professionals*" was already formulated in RADA's business plan (RADA, 2005). Collaboration between CIALCA and RADA starts in 2008 after a former CIALCA PhD candidate takes up a position at the agency (Cox, 2011). While CIALCA II started a new project period, the Crop Intensification Program is implemented and starts with its agricultural intensification activities. This would prove to change CIALCA's relationships with ISAR and RADA. First of all, CIP has its own agenda. CIP prioritizes the productivity six food crops; maize, wheat, rice, Irish potato, beans and cassava (Kathiresan, 2011). To facilitate an intensified production of these crops the program consisted of four activities: 1) land use consolidation, 2) improved seeds and fertilizers, 3) proximity of extension services, 4) post-harvest handling. CIP promotes monocropping and agricultural innovation that is designed from top down (Ansoms A. , 2009). The vision is on conflicting terms with CIALCA's vision of integrated systems; a bottom-up approach that centralizes farmer's needs (CIALCA, 2007). Nevertheless, CIALCA becomes involved in the new intensification activities of CIP via research on beans of the legume program, but the 'rules' for innovation appear to have changed. As two CIALCA researchers put it:

"CIP is a bit contrary to what CIALCA was advocating in terms of systems research. [...] don't use a small piece of land, people get together on one piece of land and don't do any kind of intercropping. Because if we are putting fertilizer on maize, we are putting fertilizer on maize. If we are putting fertilizer on potatoes we are putting it on potatoes. [CIP] was not intercropping at all. So there were some sections in CIP that are completely actually contrary to what CIALCA stood for. " (See appendix C; CIALCA_researcher1, in-depth interview phase 3)

"...we were not proponents of monocropping, land consolidation and green revolution. Well, green revolution, fine! But adapted to farmers conditions. CIP is very linear and traditional in its approach [towards agricultural development]...(See appendix C; CIALCA_researcher2, in-depth interview phase 3)

Despite numerous examples of monocropping practices in academic literature, actual policy documents like Vision 2020, NAP, PSTA and CIP do not mention monocropping or monoculture as the preferred method of crop intensification. Neither is monocropping or monoculture mentioned by annual reports from RADA. This suggests that monocropping is not regulated by formal rules in CIP policy. One CIALCA researcher explains:

"You know…the problem is communication. CIP doesn't mean monocropping. That is the way people interpret it. So when the policy came for CIP and example was given with monocrops, the association was that intensification means monocropping." (See appendix C; CIALCA_reseacher3, in-depth interview phase 3)

Despite the issue of mono cropping and top down coordinated development, the massive distribution of fertilizer under CIP presented new opportunities for CIALCA. The government had a need for new knowledge on the use of fertilizer. Workshop data revealed that MINAGRI participants attributed systematic development and sharing of knowledge as an important enabler for the implantation of CIP (see appendix B-1). As shown in table 10, farmers and NARS researcher mention how CIALCA played an important role in filling that knowledge gap. CIALCA, ISAR and RADA had an advisory relationship on the issue of fertilizer. Seeing a change to disseminate their believes about integrated systems, CIALCA took a role as knowledge producer and knowledge broker by informing stakeholders about productivity-enhancing technologies for improved legumes, maize and cassava (crops that were part of CIP) in intercropped systems (CIALCA, 2009-2011) (Macharia, et al., 2013). Having data coming in from action sides, CIALCA could provide fertilizer recommendations that were adapted to farmers' needs. Issues of 'a low rate of technology adoption by farmers' could therefore be accounted for at a national level. Besides fertilizer recommendations for intercropped systems, CIALCA's recommendations also solved constraints to intensified productivity as a result of resource scarcity (in terms of finance and availability) defined by CIP by combining organic with inorganic fertilizer. They 'sold' the advise directly to partners in RADA in a knowledge package called 'integrated soil fertility management' (ISFM) practices. One CIALCA researcher explains their contribution:

"…our contribution is one two fold. We have appropriate crop combination. For instance you take beans and cassava, with the technology that CIALCA introduced means you can grow beans twice in a cassava field before harvesting the cassava. And the beans provided the nutrients; soil nutrients and the farmers also make benefit of the produce in terms of rotation and income. Because you have the beans and cassava on the same piece of land. […], we advise [with special arrangements] to generate the same yield of cassava and the yield of beans. So the special arrangements [ISFM] are about how the land should be arranged to generate to maximize profit (CIALCA_researcher3, in-depth interview phase 3).

The workshop participants ranked ISFM as the 3rd most influential event in the process of the implementation of CIP (see appendix B). ISFM taught stakeholders on an administrative level that multiple ways of applying fertilizers to multiple crops on one plot was possible without negative effects to productivity. Proof of CIALCA's influences on CIP can be found in the PSTA II report in 2009. Governmental documents before this date do not mention the practice at all. The RAB annual report of 2012-2013 show how ISFM has become fully integrated into RAB activities (Rwanda Agricultural Board, 2013).

The divide between research and extension would be mended (in theory) in November 2010. ISAR, RADA and RARDA (Rwanda Animal Resources Development Agency) merged to form the new agency Rwanda Agricultural Board (RAB) for research and extension (Rwanda Agricultural Board, 2015). This vision of RAB is directly in line with Vision 2020. Its aim is to transform subsistence agriculture into commercial

agriculture through research and extension. It involves "crop intensification driven by the use of agricultural inputs" (Rwanda Agricultural Board, 2015). Around this time the implementation governmental development goals seemed to accelerate, perhaps because Vision 2020 was already half way. As one CIALCA researcher puts it:

[When] RAB was formed, research went almost completely down. Everything was development, development, development... they are not so much into developing technologies [...] which varieties do we have, what do we not have. Lets get it from Uganda and do it. So it was largely extension, implementing ideas coming from RAB. (See appendix C; CIALCA_researcher1, in-depth interview phase 3)

Around this time, research and capacity building seemed to continue on the path on which they had embarked. The majority of activities, also in terms of actor capacity building (recruiting PhD and MSc students) are on bananas, while a smaller amount of activities focus on ISFM and bean varieties. Participatory research with farmers resulted in the selection of new bean varieties in 2010 (see appendix B-2). Additionally, the selected beans reached the national seed program of RAB for a formal release through the national seed system (CIALCA, 2011). From 2010 and onwards to the end of 2015, no more new developments in the interactions between CIP and CIALCA are reported. Policy constraints are frequently mentioned as blocking innovation; these are usually attributed to policies promoting monocropping. CIALCA+ focuses on research for development (R4D) platforms to discuss constraints for intercropping systems and new experiments are set up. CIALCA appears to focus on CIP crops, mainly looking at legume-banana, maize-soybean and legume-cassava systems (CIALCA, 2015).

The timeline of the innovation process constructed during the workshop on which this case study was build can be found in appendix B-2.

Active and passive enablers: CIALCA's impact on the innovation process of the Crop Intensification Program

CIP presented a tough institutional environment for CIALCA. The institutional foundations that embedded the policy were built six years earlier. It started with a natural disaster that triggered an incentive for regulation. By imitating a historic institution (green revolution), governmental actors found a way to shape the problem agenda. This was supported by influential funding organizations that sustained the ideas with resources (financial resources and social resources like partnerships). The alignment of agendas at different levels generated the style of governance and selected priorities for agricultural development through formal decision-making and formal rules. CIP is a policy that is completely institutionalized on an international, regional and national level, making it (in theory) a strong and influential institution. One CIALCA researcher formulates the historic context for CIALCA to work in as follows:

"...so I see it that CIALCA jumped on a train that is already sort of moving rather than being the engineer that is driving the train". (See appendix C; CIALCA_researcher1, in-depth interviews phase 3)

CIALCA had to work within the boundaries of the institution but even in this

regulated environment opportunities to disseminate new ideas emerged. Operating on different technological and administrative levels as knowledge producers on local level and knowledge brokers on an administrative level helped CIALCA as overall knowledge manager. Embedding researchers at different levels in the innovation system helped to anticipate on technical questions on both field and administrative level, allowing them to align different needs. Active enablers, like resources (in this case networks and interaction) sustained the flow of ideas from one level to another. When technical questions on fertilizer recommendation and high performing bean varieties occurred, CIALCA could swiftly provide information.

Regarding fertilizer recommendations, CIALCA was able to fill a knowledge gap because the detailed knowledge necessary to implement CIP was missing. By packaging fertilizer recommendations for integrated systems as ISFM, CIALCA had a dissemination and communication tool that answered technical questions, regarded the risk-reduction strategies of farmers by honoring their practice of intercropping, and stayed true to CIALCA's own believes. (CIALCA, 2011). Furthermore, a knowledge package could be easily tested by NARS and validated.

Organizational capacity building, via recruiting former PhD candidates at RADA proved effective for scaling the selected bean varieties via national seed systems. One CIALCA researcher explains it as follows:

Because [RADA] where [former CIALCA PhD candidate] was seated by that time and we worked with them to develop different things. We actually got staff that was base here we recruited staff that was sitting here, the extension arm (See appendix C; CIALCA_researcher1, in-depth interviews phase 3).

In both cases of agricultural innovation (ISFM and bean), passive enables (time, rules) played an important role that added to a constitutive environment for agricultural innovation. CIALCA had the timing right by supplying solution-oriented research in CIP's implementation phase. They provided information that needed according to the national agenda and national program needs.

4.3 Case 2: Banana-Coffee intercropping in Rwanda

The case of banana-coffee intercropping (BCI) was selected because of its clear institutional constraints on a regulative level as was experienced by researchers. Attempts were made to purposefully change institutions on a national level. The case was selected in consultation with CIALCA researchers. Reports frequently mention that the practice of intercropping coffee with other crops like banana is forbidden in Rwanda (Jassonge, Asten, Wanyama, & Baret, 2012) (Ekong, 2015). Also in this case, preferred monocropping practices aren't formally mentioned in any policy documents. Nevertheless, promoting intercropping coffee with banana is challenging. Rwandan coffee farmers are keen to adopt BCI to better utilize their small plots and obtain the economic benefits (Ekong, 2015). This case study will describe CIALCA process to alter the institution of monocropping on the national administrative level.

Overview of development in the coffee sector in Rwanda

Agricultural production in Rwanda can be grouped into two main categories: food crops (legumes, cereals, roots, tubers and banana) and 'traditional' cash crops (coffee and tea). Under the EDPRS and NAP and SPTA, there has been made a difference between intensification policies for food crops and cash crops. Also in terms of institutions as a combination of rules, actors and resources, different authorities have been made responsible for overseeing the cash-crop sector.

Food crops occupy 92% of the total cultivated land in Rwanda. From this percentage, coffee occupies respectively 6,3% of the total cultivated land (MINAGRI, 2004). Despite this relatively small number, coffee was always been one of Rwanda's top export products and a main source of foreign exchange income for Rwanda (Murakezi, Songqing, & Loveridge, 2012). Since its early days as a colonial crop, the coffee sector has changed a lot in regulation but not in importance. One CIALCA researcher explained the differences in institutional establishment also in regard to monocropping as follows:

"... it is related to the history. And the current government has currently not done much. For example, coffee was giving priority in nearly all of these countries, all of them because it was a colonial crop, they liked it, they used it and they are exporting it. So they think nothing should be mixed with coffee. The banana program is still very young, it is coming up but it's still newly build. But the coffee problem was there, so it was kind of special. [...] Already established. (see appendix C; CIALCA_researcher1, in-depth interviews phase 3).

In 1986, coffee export reached its highest peak. After that year the coffee production in Rwanda has fallen into decline due to sector management failure and climatic changes (Ngabitsinze, Mukashema, Ikirezi, & Niyitanga, 2011) (Murakezi, Songqing, & Loveridge, 2012) Hunger drove farmers to remove almost 300,000 coffee trees so they could plant other, more attractive food and cash crops (Ngabitsinze, Mukashema, Ikirezi, & Niyitanga, 2011). In 2001, the earnings from coffee export amounted only one third of the earnings in 1990 (Murakezi, Songqing, & Loveridge, 2012). Furthermore, 90% of the coffee was of an ordinary grade; Rwandan coffee was sold at low prices on the international market. This triggered the government to promote

washing stations in order to produce fully washed green coffee (MINAGRI, 2004). Washing stations are a necessity to make high quality specialty coffee (Murakezi, Songqing, & Loveridge, 2012). In 2001, there were only 2 washing stations in Rwanda by 2007 there were over 120 washing stations spread across the producing regions of the country (MINAGRI, 2009). The increase in washing stations marked the beginning of the transformation of the coffee sector. Millions of additional coffee trees were planted and the use of fertilizer and pesticides was stimulated. In 2004, the National Agricultural Policy (NAP) selected coffee as a focus crop because of its contribution to export and potential contribution to sectorial growth (MINAGRI, 2004). Following the NAP in that same year, the ministry of agricultural and animal resources conducted a study into the constraints and opportunities of the coffee sector. Reduced productivity was attributed to the old age of coffee trees, low coffee prices on the international market, lack of inputs, missing extension services and the lack of motivation amongst the farmers to grow coffee (MINAGRI, 2004). The results of this study were used in the SPTA I.

To improve the quantity and quality of coffee, the sector became subject to radical reforms. The State-owned coffee production and export company, RWANDEX (which held a monopoly position at the time), was privatized in 2006, followed by the settlement of new private domestic and international coffee exporters has settled in Rwanda thanks to a more favorable business climate with reduced export taxes (MINAGRI, 2009). Later, MINAGRI outlined the Rwanda National Coffee Strategy (NCS) 2008-2012. The strategy aimed to intensify the production and raise the quality of Rwandan coffee. Key points in the strategy were; stimulating technology research, intensifying production and improving distribution channels. Farmer's knowledge and attitude toward growing coffee caused concern. Farmers, according to the strategy, need to be supported to take greater responsibility for production activities. This support would consist of education, training and promoting good farming practices through the coffee cooperatives. The efforts to improve Rwanda coffee quality were paying off in 2007 and 2008 when Rwandan coffee farmers were winning international coffee quality competitions and auction prices for the Rwanda coffee rise. (USAID, 2007) (Cup of Excellence, 2008).

However, despite the international recognition of Rwanda coffee quality, the targets set for an increase in coffee quantity was still lacking behind. In 2009, PSTA reports that agricultural exports (including coffee) will need to be expanded urgently in order to achieve the EDPRS goals of sustaining 7% growth in agricultural GPP (MINAGRI, 2009). Taking in consideration the small farm sizes in Rwanda it is emphasized that value of production per hectare need to be raised via cash crops like coffee. The strategy appoints the Rwanda Coffee Authority (OCIR-CAFÉ) to provide the necessary technical assistance to coffee growers and processors (MINAGRI, 2009).

In 2011, the National Agricultural Export Development Board was formed. It merged the Rwanda Coffee Authority (OCIR CAFÉ), Rwanda Tea Authority (OCIR THE) and Rwanda Horticulture (RHODA) into one agency responsible for managing the entire agriculture export and cash crops under the Ministry of Agriculture (NAEB, 2011). NEAB has the power to grant authorization to private processing companies, set quality standards and give out certificates of origin. The main responsibility of OCIR CAFÉ within

the agency is to supervise and coordinate activities within the stakeholder networks and formulate/implement policies (AMIS, 2016). The agency is also responsible for identifying and supporting research and engages in partnerships with NGO's. The Cup of Excellence (CoE) competition becomes an important marketing and promotion tool for NAEB. The board selects farmers to compete annually. In 2012, 2014 and 2015, Rwanda hosted the Cup of Excellence competition event (NAEB, 2013) (NAEB, 2015).

Besides efforts made to increase production, climate change appears to be overlooked as a risk to productivity. Neither NCS nor NAEB's annual reports mention climate change as priority issue. Research has proven that coffee is a crop vulnerable to climate variability (Asten, et al., 2012). Changes in climate has attributed to a lower productivity and increased risk on plant disease (Murakezi, Songqing, & Loveridge, 2012). Moreover, a study shows that climate change pushes farmers to cope with risks by 'returning' to old practices like intercropping, applying fertilizers to other crops then coffee and even abandoning coffee farming all together. Consequently climate change is one of the reasons behind a low productivity that fails to satisfy the governmental and market demand.

CIALCA's involvement: networks offer new innovation opportunities

Coffee was not part of CIALCA's focus crops. Originally the consortium combined the research expertise on bananas and beans. However, CIALCA proved to be a flexible organization when opportunities for agricultural innovation emerged. The idea of intercropping coffee with banana came into focus through networks and partnerships with CIALCA**.** It started in 2002, when the United States Agency for International Development (USAID) had started an Agricultural Productivity Enhancement Program (APEP) to enhance agricultural productivity and improve food and cash crop marketing for the development of Uganda's agricultural sector (USAID, 2005). As an expert on banana research, IITA (a CIALCA consort) becomes connected with APEP in research related to banana and coffee (APEP, 2005). APEP was looking for fertilizer recommendations for four key food and cash crops: banana, maize, coffee, and cotton. Banana is by far the most important food crop in Uganda and is closely associated with coffee (APEP, 2005). IITA submitted a research proposal for one of USAID benchmarks to draft fertilizer recommendations for at least 3 key APEP commodities (benchmark 6.13). Together, USAID and IITA collaborate in research activities to identify opportunities and constraints for improvement of the coffee-banana intercropping system (USAID, 2007). One CIALCA researcher explains how IITA's involvement and collaboration was informal affair:

"... in 2005 we started with some on-farm trails, measurement work on the program of USAID that looked at bananas and fertilizer for bananas. But they (USAID) did also some work on coffee. Then the guy who was responsible for coffee said "Hey, you (IITA) could also work on coffee". [...] And I said: "Fine, we are going to do it..." (See appendix C; CIALCA_research2, in-depth interview phase 3)

USAID and IITA had an exchange relationship. IITA actively tried to reconcile demand and supply. Interaction was based on research demands and information

exchange on fertilizer recommendations. IITA took a role as knowledge producer to fill the knowledge gap in USAID projects. Over the course of 2 years, IITA did research into soil and foliage sampling and identified and characterized farmers with coffee banana intercrop for the USAID project in Uganda (USAID, 2007). BCI as a technology proved to have positive economic benefits for farmers and reduce risks for farmers (van Asten, Wairegi, Mukasa, & Uringi, 2011). As the research progressed, positive results inspired IITA to takes the study to an international level with their partner CIALCA.

The role of CIALCA: Interaction between CIALCA and development partners

Intercropped systems in general matched CIALCA vision for improving agricultural based livelihoods in Central Africa and was therefore a partner with similar objectives. With the support of IITA as main knowledge producer, CIALCA could concentrate on the role as knowledge broker, drawing on already established networks and earlier capacity building efforts. As one CIALCA researcher explains:

"(Name) who had worked with CIALCA [as PhD candidate] from the beginning in Rwanda was very vital in making sure that the work we're doing moved ahead. [...] Some of the people that were students within CIALCA moved themselves in decision-making positions. [...] ...this meant that banana-coffee intercropping already had somebody that knew this very well and could easily sell it. " (See appendix C; CIALCA_researcher1, in-depth interviews, phase 3).

Around the time of IITA-research into BCI systems, CIALCA was emphasizing its role as promoter and disseminator of CIALCA products through collaboration with national extension services and international NGO's (CIALCA, 2009-2011). Banana-coffee intercropping was added to CIALCA's list of 'products' with the potential to be disseminated in Burundi, Rwanda and DR Congo. As a new project under development, CIALCA starts with setting up BCI trials in Burundi based on earlier IITA research (CIALCA, 2008).

CIALCA identified policies on coffee farming and the difficulty of convincing disseminating agents as the main constraints for the adoption of BCI technology. CIALCA took op the role as knowledge broker by starting dissemination with trials at station level and demonstrations (CIALCA, 2008). At the same time, SPTA II implemented a new national program for shading coffee. No studies had been done at the time to understand the field conditions under shade trees and see the performance of the established fertilizer recommendations (MINAGRI, 2009). MINAGRI had an important stake in this study, since coffee accounts for one fifth of the total usage of inorganic fertilizer (MINAGRI, 2009). This presents high costs to the planned sector growth and therefore an incentive for research. These were opportunities, but they weren't included in research programs of coffee authorities.

After new research results were coming in, CIALCA tried to disseminate BCI in Rwanda. Research results from Uganda and Burundi showed that shading coffee trees makes coffee systems more adaptable to climate change and that coffee cherries grow bigger under banana shading (CIALCA, 2011). Bigger cherries are related to a higher coffee quality, which was one of the main policy concerns. Investment in cherry

production was also part of the programs in the NCS action plan (MINAGRI, 2008). The new promising research findings allowed research to continue in order to prove the correlation between shade and coffee quality and provide detailed information on the technology for producers and development agents.

In January 2011, RAB started their own BCI trials (CIALCA, 2009-2011). The study was most likely inspired by CIALCA through workshops, as one CIALCA researcher explains:

"We had a workshop that reported on these things. So for sure they (RAB) were getting it from us. Whether directly or indirectly they had heard about it." (See appendix C; CIALCA_research2, in-depth interviews phase 3)

The results were presented in RAB's annual report 2012-2013. Also RAB concludes that '*coffee–banana intercropping is more beneficial to the farmer compared to the monocropping in terms of land utilization efficiency and economic returns*' and that '*coffee grown under shade gives stable yields with higher cup quality*'. (Rwanda Agricultural Board, 2013). The results motivated OCIR CAFÉ, NAEB, RAB and IITA/CIALCA to conduct a survey together to explore whether monocropped or intercropped coffee generated differences in yield. Knowledge about possible yield difference were important for the Rwanda coffee authority in order to evaluate whether shading would increase or decrease overall productivity. An MSc student from IITA/CIALCA conducted the study and no significant differences in yield were discovered during the study. Despite these 'neutral' results, the idea of BCI as a technology to protect coffee production from climate change was believed to strengthen the case for growing coffee and banana together (IITA, 2012). The idea was presented during the CIALCA conference in 2011 as a short policy brief. Aiming to inform the public and policy-makers, CIALCA actively used to press to disseminated information on climate smart coffee production and the story got picked up by several large media houses (CIALCA, 2011). In the next years, more research results about the benefits of BCI were coming in that aligned with production issues identified by NAEB (NAEB, 2013). Research by IITA and CIALCA showed the occurrence of coffee leaf rust was 50% lower when coffee was intercropped with banana (CIALCA, 2012).

Supported by scientific evidence and curiosity from NARS, CIALCA changed tactics and moved from their usual advisory relationship to a relationship were the researchers actively tried to persuade a stakeholder (see table 2). The responsible researcher states:

"... we had a pretty solid evidence base. And [...] the national research became interested. That's when I basically went to the minister and I tried to reach her and I waited outside her door for 3 hours." (See appendix C; CIALCA_researcher2, in-depth interviews, phase 3)

The initiative results in valuable feedback from the minister in which she revealed the concerns and uncertainties she had regarding the technology. One CIALCA researcher elaborates:

"... at one moment she mentioned in a statement like; "okay, now, I don't care whether people are

intercropping or not intercropping as long as [the] coffee quality of Rwanda will not go down." So it was not an issue of intercropping, it was an issue of quality of the coffee beans". (See appendix C; CIALCA_research1, in-depth interviews, phase 3)

CIALCA took advantage of the feedback to better align their research with the concerns and uncertainties of decision makers. Research into the effect of shade trees on coffee quality was already being done, as one CIALCA research explains:

"But at the same time, [...] we had results coming out. She actually made that statement when the results were coming out in less than a month. [...] when those results came out, they were send to show that actually the coffee quality increases". (See appendix C; CIALCA_research1, in-depth interviews, phase 3)

When it was confirmed that coffee quality improved under intercropping, the minister convened a meeting of all major actors in the coffee sector inviting research, extension, development partners, NGOs and representatives of coffee farmers and cooperatives within the country to discuss the benefits of intercropping (Ekong, 2015). This workshop was held on 15th March 2013. MINAGRI reports on the workshop:

"the idea is rooted in that intercropping as being more resilient and profitable than monocropping [...] This workshop is an indication of a change that may occur within the agriculture sector for Rwanda, that will ultimately benefit rural farmers and market prices for the country, as research continues". (Lee M. , 2013).

On this same day, the minister met with actors from Starbucks. During this meeting, the minister referred to the banana-coffee intercrop study conducted in Uganda. Starbucks probably added more uncertainty to the technology, when commenting that '*density and altitude must be put into consideration to produce a successful intercropping plantation*'. (Kayitare, 2013). Despite the interest in the research findings presented by IITA, stakeholders still needed to set up their own trials in order to validate the idea of intercropping. Some concerns could not be taken away by scientific evidence. As one CIALCA researcher explains:

"You know, research has shown that intercropping banana's and coffee is profitable. But the reality on ground is that farmers do not consume coffee and do want to cultivate crops they can consume. So if they would go ahead to put banana into coffee farms, then banana will become a major crop and coffee will become a subsidized crop. But [farmers] will give more attention to bananas and gradually all the coffee farms will be replaced by banana. Because [farmers] can eat banana.... (See appendix C; CIALCA_researcher3, in-depth interviews, phase 3)

Also, risks of climate change were not part of the NCP priorities. And because yield did not differ between intercrop and monocrop systems, the benefit for policymakers would be the improved quality of the coffee bean under shade trees. This would have to way up against the perceived risks of allowing farmers to intercrop their coffee trees with banana. In the aftermath of the meeting, initiatives were taken by the authorities to set up more trials. IITA and CIALCA packaged their research into an implementation guide for policymakers and investors (Asten, Ochola, Wairegi, Nibasumba, Jassogne, & Mukasa, 2015). This could be circulated to relevant actors.

(Ekong, 2015). These appeared to be the last reported CIALCA efforts to disseminate BCI technology.

The timeline of the innovation process on which this case study was build can be found in appendix B-3.

Active and passive enablers: CIALCA's impact on the national coffee policy.

Rwandan coffee policy rationale believes that even though the world prices for commercial grade coffee are declining; the price of high quality coffee remains strong. Intensifying the production of high quality coffee is the aim of the NCP. Constraints to this aim are (according to NCP) farmer's motivation and poor farm practices. When CIALCA and IITA presented BCI as a technique that generated economic benefits for farmers it didn't align with concerns of decision makers (Jassonge, Asten, Wanyama, & Baret, 2012). On the contrary, in the 1990's, farmers had uprooted coffee trees in order to grow food crops like bananas. New research results on the effects of shade upon coffee trees allowed CIALCA to 're-frame' BCI as a climate-smart technology that reduced risks to coffee production. Despite the evidence and interest of NARS, the idea of banana-coffee intercropping wasn't moving ahead until CIALCA started to change the boundary arrangement with governmental stakeholders. CIALCA more actively started to take up the role as innovation managers; managing boundary arrangements, using embedded researchers to 'get a next appointment' (former CIALCA PhD candidates) and addressing institutional constraint (monocropping) directly. With the help of IITA as knowledge producer, CIALCA actively needed to take up the role as knowledge broker and knowledge manager to allow for swift answers to new uncertainties with scientific evidence.

Despite the role as knowledge managers and all the scientific evidence to support the case, decision makers were hesitating. More trials were needed but the authorities organized these independently of CIALCA. However, according to CIALCA research, a change in attitude has been observed. As one CIALCA researcher recalls:

"...it was only when the minister and the government that organized the meeting around it [...] gave a sign of approval. [...] There was a change of discourse of midlevel people; much more tolerant. Validation was taking place." (See appendix C; CIALCA_researcher2, in-depth interviews phase 3)

CIALCA's impact has been moderate; achieving a change in attitude toward BCI However, in terms of visibility, CIALCA dissemination reached many interested new parties like media channels, coffee authorities and private sector. In this case, actors were active enablers, managing earlier boundary arrangements and changing them. Resources sustained the appointments, but had less value later on in the process. Certain resources, like ties with NAEB and the private sector were missing, giving CIALCA little insight in their objective and needs. Furthermore, rules were much stricter in terms of orthodoxy based on the colonial past of coffee as a crop. Lastly, time affected the priority status of climate smart technologies, because focus areas for development were quality and production.

5. Comparative analysis & discussion

The results from the data collection focused on reconstructing the institutional environment for Agricultural Research & Development in Rwanda and CIALCA's experiences in facilitating institutional change through agricultural innovations like: ISFM, new bean varieties and BCI. The institutional innovation process that was triggered by CIALCA in Rwanda in both of these cases was the change in monocropping-policy. In this chapter, the cases of CIP and BCI will be compared to analyse the similarities and differences between the cases and explore how and under which conditions (passive enablers; rules/time) CIALCA's strategies of applied systems research and their role as knowledge manager and innovation manager (active enablers: actors/resources) were deployed successfully in generating alterations in the actor- and resource-capacity of institutions. Key evaluation questions are: 1) *how did CIALCA facilitate or support institutional innovation* 2) *what strategies were used to make changes in the actor and resource capacity of institutions* and 3) *what were drivers that cause a loss in capacity of the old institution.* The answers are structured according to the research sub questions.

5.1 Key characteristics in institutional innovation per case

CIALCA triggered an institutional innovation process to generate space for innovation for two different agricultural innovations ISFM and BCI. This space was constraint by the institution of monocropping. To answer the second research sub question ('*what are the key characteristics (actors, rules, resources and time) of the case of institutional innovation*'), the two cases CIP and BCI will be compared.

Similar in both cases were CIALCA's effort to incorporate systems thinking into national policy programs. In case of CIP, CIALCA contributed with ISFM practices for intercropped systems and faced institutional constraints in terms of promoted monocropping practices. In case of BCI, intercropping was the starting point for engaging in institutional innovation. In both cases, institutional change was needed to disseminate ISFM and BCI. More similarities between the cases were found in the institutional environment that embedded monocropping practices. Both cases are connected through a structure of regulative rules: Vision 2020, EDPRS, PSTA and NAP. BCI and CIP are products of process of these policies for agricultural transformation. Later the policies differentiated by becoming more crop specific, splitting program and strategies for agricultural transformation into plans for food crops and plans for cash crops. This split shows that food crops and cash crops are cognitively classified differently and also need separate authorities to coordinate their development. What cognitively connects the food authority and cash crop authority are certain 'believes' about monocrop-oriented development and coordination. The organizational structure doesn't support intercropped systems in terms of interaction through networks and collaboration (see appendix C; CIALCA_researcher1). The separation of crops into different authorities and working groups is based on orthodoxy; something that is taken

for granted (Geels F. W., 2005). The separation grew overtime, as one CIALCA researcher explained:

"...it is related to the history in a sense that these ones were separately build". (see appendix C; CIALCA_researcher1, in-depth interviews phase 3

Monocrop-oriented development has become both a cognitive and normative rule, not necessarily supported through formally documented rules, but embedded and enforced non-the-less because of established governance structures. This suggests an enduring institution that can only change when all rules are converted; a change in cognitive rules would also require a change in regulative rules. (Geels F. , 2004).

CIALCA supported and facilitated institutional innovations like intercropping through agricultural innovations like ISFM and BCI. The reconstruction of the cases show that CIALCA's main strategy was to give demonstrations on farm level (different stakeholders were invited to participate) and engaged in processes of learning with stakeholders on a technical and administrative level (see table 10, and appendix B-1). Also CIALCA, via agreements with ISAR, was able to build actor capacity in both cases. Former CIALCA PhD students that were in decision-making positions at ISAR, RADA or RAB allowed ideas about intercropping to pass more easily inside stakeholder inside key organizations for development. The 'learning' strategy that CIALCA choose by facilitating actors and supporting resources were able enact and sustain the new idea while key-actors from RAB engaged in a process of assessing its legitimacy, relevance and credibility. The cases show that the strategy varied in its success between the cases.

In case of CIP, the CIALCA strategy successfully disseminated ISFM and new bean varieties. A possible reason for the success, compared to BCI, was that ISFM dealt with intercropped systems of food-crops only within a network of reasonable homogenous actors with a background in 'domestic' agriculture. It did not involve the private sector, nor did it involve risks to foreign exchange and the export market. This might have made it easier for stakeholders in decision-making positions to oversee the necessary changes to certain institutional rules like altering governance structures: like the extension of formal fertilizer recommendations and practices in case of ISFM.

This struggle for legitimacy for an agricultural innovation is most visible in the case of banana-coffee intercropping. The same strategy of learning through scientific evidence, capacity building and networks was less successful in case of BCI. This agricultural innovation required interaction between food and cash crop authorities that have been working separately since colonial days (van Asten et al., 2011). Capacity building effort from CIALCA had allow former CIALCA actors to be situated in a decision-making position in RAB, but not in NAEB, therefore missing 'entrance' into one of the most influential decision makers that could have helped to understand objectives and better align needs. BCI involved a heterogeneous group of stakeholders, including an influential private sector actor like Starbucks. Also the authorities involved were heterogeneous, based on history, classification of crops (food and cash crops) and development priorities (coffee export is an important crop for foreign revenue). The process of 'validation' (assessing legitimacy, relevance and credibility) of BCI would have

to pass through a group of actors with very different professional working culture, needs and objectives. Furthermore, high uncertainty about the impact of BCI on farmer's motivation played an important role. The scientific evidence provided by CIALCA's consortium leader IITA could not take this uncertainty away. In case of BCI, capacity building missed important innovation players and learning was not enough to convince all actors. The strategy of learning can be successful, but appears to be strongly conditioned by active enablers like resources (in terms of capacity building and networks) and passive enablers like rules (in terms of governance structures and perceived risks)

A literature study on institutional durability and change shares similar theoretical ideas about the conditions for a learning strategy for institutional change. Clemens and Cook (1999) argue that once actors (like a CIALCA stakeholder) have knowledge of an institution, it gives them the ability to convert it. Without knowledge, the capacity to alter mental models cannot happen. Knowledge therefore may produce innovation. Strategies that involve processes of learning are conditioned by two historic social events; the mutability and multiplicity of institutional arrangements. The mutability of an institution is embedded in the rules. Regulative rules maximize accurate reproduction by actors and generate the greatest stability and reduced risk perceptions. When actors desire this stability (for example due to orthodox cognitions), rules are general regulative in nature and state that; *something 'must' be done like this*. Examples of 'must' rules are laws and regulations. These kinds of rules leave little room for change. Rules can also be formulated like; *something 'must not' be done like this,* or *'may' be done like this*. According to Clemens and Cook (1999) these kinds of rules offer suggestions that things can be done in a different way. This offers space for innovation. In case of making changes to the institution of monocropping: research data from governmental documents suggest that the institution wasn't necessarily formally embedded in 'must' rules. This might indicate that monocropping was indeed embedded in cognition and normative behaviour. According to Clemens and Cook (1999), this increases the possibility of change under the right conditions. Multiplicity refers to homogenous or heterogeneous characteristics of groups. Clemens and Cook argue that the capacity to conceive new ideas is inherently connected to the diversity amongst actors. Change is possible once institutions are no longer perceived as inevitable. However, the cases show that amongst heterogeneous actors, especially when new ideas are not conceived within the powerful groups, new ideas have a higher change of being perceived legitimate, relevant or credible. Therefore, multiplicity needs to be more specific. Multiplicity might stimulate a flow of diverse ideas, but under conditions of orthodoxy and power (like in case of BCI), heterogeneous groups might have little positive effect on innovation. In case of CIP, CIALCA actors were embedded in powerful agencies, allowing them to respond adequately to information needs so innovations could be better aligned with stakeholder objectives. Also, the actors in the innovation system were more homogenous, connected via food crops only, allowing for a smoother validation process.

Conditions of mutability and multiplicity influenced the impact of CIALCA's learning strategy on altering the actor- and resource-capacity of the institutions of monocropping. In case of CIP, disseminating ISFM appears to be successful because of the right combination of actors into a group that wasn't too heterogeneous or

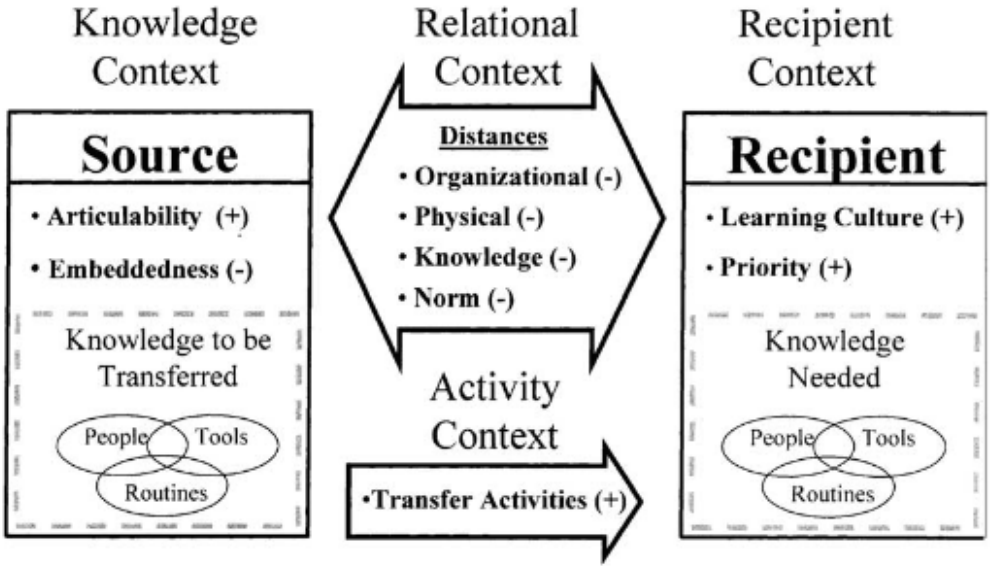
homogenous in character and because consequences to changes in the governance structures of monocropping were easier to comprehend. In case of BCI, disseminating the agricultural innovation was less successful because of the heterogeneity of powerful actors, a lack of capacity inside influential organizations and because consequences tot changes in governance structures were difficult to comprehend (risk perception and uncertainty was high).

5.2 The role of CIALCA in the institutional innovation process

The third research question of this thesis looked at '*the role of CIALCA during different phases of the innovation process*'. Within the context of monocropping, CIALCA deployed different aspects in their role as knowledge manager and innovation manager. How successful were they? Knowledge management involves knowledge production, brokering and packing. CIALCA disseminated knowledge produced by consortium partners as knowledge brokers, drawing on their networks in technical and administrative levels. As knowledge brokers, CIALCA was mentioned by interviewees as successful in capacity building, this was crucial in the development of pathways for new ideas to be disseminated and generate processes joint knowledge production. In both cases this strategy was deployed, but was less successful in BCI due to passive enablers, as was explained earlier. Furthermore, CIALCA informed, mostly farmers, of technologies and disseminated them. Interviewees didn't mention matchmaking or consultation specifically. Matchmaking however was integrated in CIALCA's capacity building strategy was part of the agreement with ISAR/RADA/RAB to recruit staff.

As knowledge packagers, CIALCA was successful in both CIP and BCI. Looking at the timelines of both cases, knowledge packing seems to ease the dissemination of ideas. In case of CIP, ISFM appears suddenly in RAB documents, while before the term hasn't been used. In case of BCI, framing the technology as climate smart linked decision makers' objectives to the idea. However, despite the interest, discussion and validation process for BCI, the idea proved to be more difficult to adopt. There are several explanations for this result. Cummings and Teng (2003) research into knowledge transfer success explains the balance between knowledge context, relational context and recipient context for knowledge transfers (see figure 3). Under 'knowledge to be transferred', the research explain how a knowledge package should contain information about people, tools (skills) and routines (structure, networks). This package of knowledge should align with recipients need for knowledge. Note, in this model, embeddedness has a different meaning then embedding of researcher (as explained in this study). Embeddedness in this context of knowledge transfer looks at the embedding of mental models.

Figure 3:
Model of knowledge transfer success (Cummings & Teng, 2003)



However, besides that the knowledge packages have to contain specific information about people, tools and routines, it is also affected by institutional conditions, closely related to active and passive enablers. Transfer activities, like interaction increases the success of knowledge transfers, while distance, in terms of normative rules, organizational structures and physical inclusiveness and interaction between actors, decrease the success of knowledge transfers. Furthermore, priorities, learning culture (cognitive rules) affect knowledge needs from recipients. These findings from Cummings and Teng (2003) seem to validate the earlier analysis of differences in successfully altering the institution of monocropping in case of CIP and BCI. Coffee was given a high priority in Rwanda's development plans and learning culture was based on orthodoxy. This affected knowledge needs. Even though 'climate smart' matched recipient's concerns about coffee production, the knowledge that was transferred to solve this problems was too divergent from people, tools and routines. This misalignment of knowledge needs might have been caused by distance in relations between CIALCA and coffee authorities.

As innovation managers, CIALCA researchers deployed various strategies, but were often constrained by a top-down governance structure. For instance: CIALCA only altered the boundary arrangement with MINAGRI in the case of BCI, when researchers actively tried to influence monocropping policies. In case of CIP, the boundary arrangements, according to CIALCA researchers, remained advisory throughout the process. The relatively fixed boundary arrangements between CIALCA and NARS might have been caused by the institutional environment in Rwanda that ordains NGO's to register at the National Development Board. This registration is required in order to work legally in the country. This form of enforced collaboration with national agencies allows authorities to monitor NGO's activities and involve them in governmental development

plans (ICNL, 2016). This coercive method provides the government with a legal basis to control NGO activities, which allows them to preserve stability in interaction.

CIALCA researchers deployed adaptive capacity (embedding researchers in the system) as strategy that proved to be useful. Both cases former CIALCA PhD students were helpful in the dissemination of information about technologies, this network moved ideas further through the innovation process. What certainly helped this strategy was that, at the start, CIALCA already breaks with an important institutional constraint in A4&D projects: a lack of time. As mentioned before, traditional research projects have a time frame of 3-4 years, which usually is too short to really change institutional arrangements. CIALCA takes a medium-to-long term vision that extends beyond the current phase of projects (CIALCA, 2006). This has given CIALCA the opportunity to build networks for disseminating ideas.

Managing an enabling environment to facilitate continuous stakeholder learning, proved to be a challenge. As explained in the previous chapter, learning strategies are depended on the mutability and multiplicity of the institutional environment. This is one of the many ways in which the top-down governance culture presents challenges to AR4D organizations. However, it also offers a constitutive environment when governmental needs are identified. In case of CIP, the environment of innovation was open to technical ideas. In case of CIP, collaboration with authorities was fruitful, based on the interviews and documentation. The goals of 'intensification' were defined in strategies that involved technical innovations: the use of fertilizer and improved seeds. Supported by agronomic experts, CIALCA could contribute with technical knowledge. In case of BCI, needs from authorities were less clear because there was no direct interaction with them.

CIALCA, from its inception did try to enhance reflexive monitoring and evaluation and strategic adjustment of policy and innovation processes via networks on technical and administrative level but did not address institutional constraint and power asymmetries. In Rwanda, farmers and policy makers live in very different contextual situations from one another. The workshops revealed that extensionists and governmental actors are prejudiced towards farmers. Influential steps in CIP were often categorized as challenging because of social/cultural norms and values or farmers resistance to change. They believe poverty is a state of mind and can be overcome with education and top down extension work (Ansoms A. , 2009) By operating on administrative and technical level, CIALCA was able to explore farmer's institutions and administrative institutions and experiment with tools to align them (for example via knowledge packages). Efforts to actively support the process of connecting stakeholders were starting in 2014 under Humid Tropics, via Innovation Platforms. In an evaluative study of the performance of Innovation Platforms similar struggles like structural power inequalities between stakeholders and integration of expert and lay competences were reported (Schut, et al., 2015).

CIALCA+ begins by adding social science research to better understand the interaction of institutions across dimensions, levels and scale. While the origin of change in radical processes is easier to pinpoint, incremental change is less well known because the slow process of the change makes it hard to determine the locus of where the

change came from and when it happened (Clemens & Cook, 1999). Determining what contributed to the change becomes a matter of scientific preference or professionalism. This is reflected in the many subfields of institutionalism that studies institutions through different lenses, gender roles, economy or history (Mackay, Kenny, & Chappell, 2010) generates different data. In the later stages of CIALCA, gender studies are being included (which also matches the United Nations MDG's. More interdisciplinary research might be necessary to better understand the dynamics and dimensions of institutional interaction. Different research lenses like, economic studies, political studies or anthropology studies, might contribute to the understanding of the institutional environment in AR4D (Geels F. , 2011).

Table 2:
Summary of the comparative analysis between case 1 and case 2

Comparative analysis
CIALCA's strategy of knowledge management and innovation management varied in success because: • The environment in case 2 was more orthodox then in case 1 (cash crops vs food crops) • Key actors were more homogenous in case 1 then in case 2 • Insufficient capacity was build in case 2, making it difficult to align needs and objectives • Learning strategies weren't as successful in case 2 then in case 1 • Boundary arrangement worked constitutive in case 1 but constraining in case 2 • Changes to institutional arrangements were easier to comprehend in case 1 then in case 2

5.3 What generic lessons can be learned that support institutions innovation through AR4D in other contexts?

This comparison shows that supporting institutional innovation doesn't follow a standard recipe. Passive enablers (rules and time) strongly dictate the space for innovation, especially in a top down culture. In such a culture, active enablers (actors, resources) need careful consideration when deploying them strategically within the space that passive enablers provide. This cultural top-down context isn't unique to Rwanda, but is practiced in many more countries. Therefor, this context can be used to learn generic lessons about supporting institutional innovation through AR4D:

While CIALCA's strategies to disseminate agricultural innovation were the similar in both cases, overcoming the institutional constraint of monocropping booked different successes. In case of CIP, capacity building into key decision-making agencies was an important active enabler of institutional change, which allowed CIALCA to discover research needs and via former PhD students ideas, research results flowed easier through the innovation system. This link with former PhD students was missing in BCI because therefor CIALCA had no actors inside some key decision-making agencies like NAEB. Also, BCI dealt with a more heterogeneous group of actors then was the case with CIP, making it harder for a technology like BCI to align objectives and needs. Orthodoxy played a role in both cases, but appeared to be less strictly enacted, sustained and

embedded in case of CIP then in BCI, probably because of the economic value, priority, historic institutions and political meaning of the cash crop coffee. CIP dealt with crops with less perceived risk to foreign exchange or overall management by authorities. This shows that formal rules established by authorities strongly shape a process of change, but also cognitive and normative rules about believes that deal with coffee management. These believes, compared to CIP were older and established through processes of institutional isomorphism. The divide between cash and food crops are also not unique to Rwanda, but are managed similarly in countries like Burundi and Uganda. Therefor, understanding the importance and culture of a crop within the innovation system is important to identify key players and their cognitive, normative and regulative institutional structure. This will give guidelines to researchers as to how new knowledge and innovative ideas needs to be strategically managed in order to achieve innovation. The cases show that CIALCA took up the role as knowledge manager and innovation manager, supported by consortium partners who took up the role as knowledge producers. The consortium successfully deployed knowledge management strategies like; information dissemination via learning, capacity building and knowledge packaging. However, learning strategies were less successful in case of BCI because of misalignment of information needs due to a lack of embedded researchers in coffee authorities compared to the actor capacity inside governmental agencies in case of CIP. Knowledge packaging proved a successful strategy in both case. A package allows answering recipients knowledge needs. Furthermore, innovation management was challenged by top-down governance structures that coordinated CIALCA's boundary arrangements with administrative agents. In case of BCI, CIALCA tried to change boundary arrangement with moderate success. In case of CIP, boundary arrangements didn't need to be changed, because the institutional environment functioned more constitutive to new ideas like ISFM. BCI shows that trying to change boundary arrangements can open up space for innovation. However, no conclusions can be made based on this one case.

In general, successful dissemination of agricultural innovation through learning strategies is strongly effected by the relationship between active and passive enablers in the institutional environment. It is important for researchers to map out the institutional environment they are working in before embarking on a (institutional) innovation process. Researchers should join together to explore their options for interaction with other stakeholders and formulate a strategy. It is also important for researchers, especially those who are not familiar with a top-down culture to explore both positive and negative sides of this method of governance. Top-down governance structures strongly dictate the space for innovation as well as boundary arrangements. This might be experienced by (Western) researchers are constraining. However, top-down governance can also speed up processes of innovation and allow innovations to have an impact on national scale. Researchers should be aware of institutional isomorphism in their own environment. Researchers should also try to understand the impact of changing institutions. For example cash and food crops deal with different authorities and therefor with different institutional structures. While researchers might think change is easy, other stakeholders might have different believes about this. Respect and understanding for the difficulty of conceiving and processes of new ideas is therefor

important. Furthermore, in an innovation process, researchers should try to involve relevant stakeholders earlier. Inviting stakeholder should not only happen at the end of a research process during the presentation of results. Institutional change needs time to grow and develop cognitive, normative and regulative ideas. These ideas also need time to be negotiated between stakeholders. This needs to happen in a group of relevant stakeholders where everyone is and active listener and speaker and not only an audience. In such process, questions may arise that are not agronomic in nature, since stakeholders are diverse in their background and objectives. Interdisciplinary research, coming from political and economic studies might help to respond to questions that are not agronomic (technical) in nature. This could help decision makers to get a better overview of necessary changes to cognitive, normative and regulative rules that are needed to support, embed and sustain a new innovation. Understanding stakeholder is important to be able design a knowledge package that aligns with recipients' need for information. Designing a knowledge package requires stakeholders requires a thorough understanding of the recipients information needs. A stakeholder analysis might be necessary to explore in what kind of format research can be packaged in its most persuasive way.

6. Conclusion

The study was set out to explore the concept of institutional innovation in AR4D and the role of research organization like CIALCA in facilitating institutional change. Understanding institutional innovation can be supported can break established mental models of behaviour, perception and choices, hereby generating a more open and tolerant environment for (agricultural) innovation with more opportunities for change and a reduced risk on system failures. In order to create space for change, it was assumed, based on theoretical literature that institutions change when there is a loss of active enablers (human and resource capacity) that enact and sustain the institution, under certain conditions from passive enablers (rules and time) that embed the institution. By examining the functioning of actors, rules, resources and time as drivers in an institutional innovation process by comparing two cases where researchers of CIALCA engaged in institutional innovation, this study sought to explore this assumption. The main empirical findings are specific to the research questions per analyzed case and were summarized in the respective chapter: '*What generic lessons can be learned that support institutional innovation through AR4D in other contexts*'. This section will synthesize the empirical findings to answer the study's research question:

What roles or functions can research organizations fulfil in supporting institutional innovation processes in Agricultural Innovation Systems?" The organisational structure and long-term vision of CIALCA proved successful in engaging in an institutional innovation process. It could draw on capacity, knowledge and networks to take up a role as knowledge and innovation manager. These roles supported the reflective capacity of decision makers and other stakeholders of current practises hereby generating space for change that benefitted the impact and adoption of agricultural innovation across administrative and technical levels. However passive enablers, such as time and rules depending on a countries governance structure, strongly dictate the strategic space for research organisations to deploy active enablers like actors and resources. Managing this space strategically is important to safeguard a constitutive innovation space. Furthermore, the division between cash and food crops asks for a different knowledge and innovation management approach, because institutional structures are different and risk perceptions are higher in case of cash crops.

The complex relationship between passive and active enablers to facilitate institutional innovation continues to be a challenge for AR4D to support agricultural innovation. To generate achievable agricultural innovation strategies with regards to institutional innovation, there is need for more case studies at the administrative level but also within the private sector level (as was shown with BCI) to allow a more in-depth assessment of interaction of institutions across levels and dimensions. Supporting interdisciplinary research into these dimensions could help to describe institutional structures that affect innovation pathways in more detail. Future research strategies that explore the role of risk perceptions on institutional isomorphism, can give insight into the risk reducing and stabilizing function of cognitive, normative and regulative rules. This may add to the understanding of the role of institutions in agricultural innovation systems and help to formulate new innovation management roles and test them. Also,

looking at normative change through a less of persuasive communication studies can provide researchers with practical skills that can apply to make research more persuasive to stakeholders. Studies on compliance and conformity by Cialdini (2004) show that normative change is achieved easier when the message is directed to multiple actors (belonging to a similar stakeholder group) so they can persuade each other at act according to new normative rules. This research finding can be interesting in the selection and number of stakeholders invited to attend an Innovation Platform meeting.

This study has offered a reflection on the role of research in facilitating institutional innovation, and was conducted in an administrative and technical environment through interviews and participatory assessment workshop. As a direct consequence of this methodology, the study encountered a number of limitations, which need to be considered:

- Asking to assess and reflect upon cognitive, normative and regulative rules can be difficult in top-down culture. Reflections might easily be seen as criticism while they are only meant to uncover structures. This might have pushed interviewees and workshop participants to answer more positively about innovation processes and CIALCA's contribution.
- Data that relies on memory is often stripped of important details in an innovation process like dates, participants in interaction or other events that did not seem important at the time, but had an effect after all. This was accounted for by documentation research, but more detailed data, like minutes, surveys taken at the time of the innovation process or recording for meetings could have contained more valuable details about objectives, needs, priorities, cognitions and norms.
- Regulative rules are often very visible when embedded in laws or policies. This is not the case with cognitive or regulative rules. During interviews and workshop, institutions that are taken for granted might have been missed; because participants and interviewees are not aware of their influence and therefore do not mention it. It requires quite some reflection skills to recognize 'conditioned' behavior. Especially because the dataset of this study was small, important cognitive or normative reflections might have been missed.
- Governmental documents that were found in databases were often 'draft' versions. Final versions were not available. Final versions could have contained valuable changes, offering new information.

Roles for research organizations like innovation management and knowledge management asks for budget and capacity, which needs to be calculated for in project plans. Therefor, research organisations need to reflect on their own objectives and capacity in terms of societal impact. Institutional innovation will always be a slow and incremental process and therefor requires commitment to tasks that are not benefitting research or publications. However incremental and complex, supporting and facilitating institutional innovation is rewarding. As this research has shown engaging in institutional innovation via learning strategies can generate a more open and tolerant environment for innovation with more opportunities for change that benefits society.

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Appendix

- Appendix A.
  Phase 1; Interview form semi-structured interviews for case selection.

- Appendix B.
  Phase 2; results from both participatory assessment workshops.
  - B-1 Overview of influential events in the process of CIP, mentioned by participants. Categorized according to similarity and rank.
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Appendix A. Phase 1; interview form semi-structured interviews for case selection.

MSc Field research
Qualitative interview form

Date: _____

Interview number: _____

Stakeholder category: _____

Interviewee age: _____

Interviewee gender: _____

Name:_____

Suggested interview by:_____

Exploring cases of institutional innovation

1. Can you describe the work of CIALCA in Rwanda to me?

   _____

2. How did CIALCA contribute to agricultural development in Rwanda?

   _____

3. What kind of innovations did CIALCA suggest?

   _____

4. How did they manage these innovations (in the light of uncertainty, doubt, organizational obstacles or other constraints)

   _____

5. What do you think is essential in institutional innovation?

   _____

Notes:

_____

Appendix B. Phase 2; results from both participatory assessment workshops

B-1 Overview of influential events in the process of CIP, mentioned by participants. Categorized according to similarity and rank

Stakeholder	Describe the process of CIP with 5 most influential events	Categories of innovation systems.	Rank	Weight	TOTAL
Farmers	Land use consolidation	Agricultural policies	1	5	**10**
MINAGRI	Land fragmentation, inadequate land use.	Social cultural norms/values	5	1	
Private Sector	Efficient use of land	Agricultural policies	2	4	
MINAGRI	Poverty, low crop production	Regulation incentives	1	5	**9**
Private sector	Food availability	Agricultural policies	2	4	
Farmers	The use of fertilizer	Social cultural norms/values	2	4	**8**
MINAGRI	Inputs/fertilizer/ISMF	Systematic development and sharing of knowledge and information (strategic intelligence)	2	4	
Extensionists	Establishments of demonstration plots for farmers mobilization	Systematic development and sharing of knowledge and information	2	4	**6**
Researchers	Testing of technologies via demonstration plots	Access to knowledge and education	4	2	
Extensionists	Technology adoption	Resistance to change	3	3	**6**
Private sector	Adoption of improved agricultural technologies	Social-cultural norms and values	3	3	
Farmers	Proximity of extension services	Access to knowledge and education.	3	3	**5**
Extensionists	Technology extension	Existence of representative bodies	4	2	
Extensionists	Research of soil and the introduction of new varieties	Existence of representative bodies	1	5	**5**
Researchers	Good collaboration between stakeholders	Multi-stakeholder interaction for learning and problem-solving	1	5	**5**
Researchers	Existing constraints in agricultural production	Systematic development and sharing of knowledge and information	2	4	**4**
Farmers	Increasing production by increasing arable land	Multi-stakeholder interaction for learning and problem-solving	2	4	**4**
Farmers	Linking farmers to market (through cooperatives).	Market access	5	1	**3**
Private sector	Linking to markets	Market access	4	2	
Researchers	Inventory & Development of technologies to address existing constraints	Agricultural policies	3	3	**3**
MINAGRI	Lack of mechanical technology	Agricultural machines	4	2	**2**
Extensionists	M&E (monitoring and evaluation)	M&E networks	5	1	**1**
Private sector	Integrated research for development (IARD)	Multi-stakeholder interaction for learning and problem-solving	5	1	**1**
Researchers	Dissemination campaign by all stakeholders at large scale and post-harvest handling	M&E networks	5	1	**1**

B-2 Timeline CIP

Crop intensification program, innovation process timeline (CIALCA), workshop data (16/17 september 2015)

Timeline	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
CIALCA timeline							Start CIALCA	CIALCA I			CIALCA II			CIALCA+		Into Humidtropics	
Private sector																	
							Institutional arrangement for CIP being made										
Extension service																	
	Hunger in Rwanda																
		High import of food															
Farmers																	
	Local administration decentralisation																
			NAP														
								Law on Cooperative being implemented									
									New Minister of MINAGRI, efforts are made to subsidize fertilizers. Kitchen gardens are being advocated								
										Post harvest handling becomes important. Anti-soil erosion technologies being disseminated by MINAGRI							
											Vouchers system for fertilizers and maize seeds are being implemented. Farmer return agricultural machines to MINAGRI after negative feedback						
												Severe drought and land use consolidation is being implemented					
													Land consolidated to grow rice				
														Abolition of straw houses to protect harvest.			
MINAGRI																	
		Vision 2020															
			EDPRS														
				Land use consolidation being advocated													
						PSTA I, NAP											
								MDG's of the United Nations									
									Crop Intensification Program is being implemented								
										PSTA II							
															PSTA III		
CIALCA activities																	
							Identifying existing constraints in agricultural production followed by the development of an inventory of products										
											Technologies being tested in collaboration with RADA/ISAR and adapted						
												CIALCA dissemination campaign with stakeholders. Release of new bean and soy bean varieties in collaboration with RAB					
													CIALCA continues to disseminate technologies in inventory. CIALCA conference				
														Greater involvement of the private sector is needed			
															Dissemination continues. Research being done to further adapt and align technologies with stakeholders		
																IP's	

Stakeholder participant groups

B-3 Timeline BCI

B-4 Credible, relevant, legitimate results of influential events in the process of CIP

Grade						
■ = selection by stakeholder	0	2	4	6	8	10

Farmers

Influential event in the process of CIP	Relevant						Credible						Legitimacy					
Land use consolidation	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10
Use of fertilizer	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10
Proximity of extension services	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10
Increasing production by increasing arable land	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10
Linking farmers to market by grouping them and the harvest (through cooperatives). Harvest easier to sell	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10

MINAGRI

Influential event in the process of CIP	Relevant						Credible						Legitimacy					
Poverty, low crop production	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10
Inputs/fertilizer/ISMF	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10
MDG's	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10
Lack of agri-technologies; mechanization, irrigation	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10
Land fragmentation, inadequate land use.	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10

RAB/Extension

Influential event in the process of CIP	Relevant						Credible						Legitimacy					
Research of soil and the introduction of new varieties	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10
Establishments of demonstration plots for farmers mobilization	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10
Technology adoption	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10
Technology extension	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10
M&E	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10

Private sector

Influential event in the process of CIP	Relevant						Credible						Legitimacy					
Food availability	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10
Efficient use of land	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10
Adoption of improved agricultural technologies	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10
Linking to markets	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10
IAR4D	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10

Research

Influential event in the process of CIP	Relevant						Credible						Legitimacy					
Good collaboration between stakeholders	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10
Existing constraints in agricultural production	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10
Inventory & Development of technologies to address existing constraints	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10
Testing and adaptation of technologies	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10
Dissemination campaign by all stakeholders at large scale and post-harvest handling	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10

Appendix C. Phase 3; transcribed in-depth interview with CIALCA researchers.

C.1 Interview CIALCA researcher 1 about achieving legitimacy (from CIALCA to Government) for a new idea/innovation.

Date: 12 October 2015
Location: IITA office, Kampala

CIALCA_researcher1: Good, you can start the questions, you are recording already?
Interviewer_EvS: Yes I am recording. Euhm, yes, so I am interested in how legitimacy is achieved, and I am looking at that now through specific cases, so what I would like to know from you is 'how did CIALCA reach legitimacy in the case of intercropping system of banana and coffee. So the legitimacy towards the government how did that go?
CIALCA_researcher1: Ah, legitimacy. Yeah it was interesting because I think if you talk about CIALCA, and we're talking about RWANDA, reaching legitimacy completely (...) in a way that for RWANDA probably legitimacy...was you to the able to work there you have to accepted and go through certain rules and regulations so for all the countries we worked in I think it was a place where legitimacy was mostly wanted and so what I think helped was...if you compare DRC and Burundi what helped was worked that had already had results that had been produced in other countries. While the practice was being done by the people, the government who were of course against it, they against any sort of intercropping. But we had results that the government could look at and accept. Going on, hand in hand with their own trails, so there were trails that were being done there were results that were coming in especially for Rwanda, especially results coming in from Burundi because they see Burundi as being closer from Rwanda and maybe see results (...) so it was a two way thing. Legitimacy was achieved by 'ONE' engaging RAB. RAB was engaged in terms of validation and seeing how much money or what yield is going to come from this. That is sort of euhm...made legitimate the process but also the fact that there were already results already existing from these other countries, on coffee and banana. Especially work coming from Burundi it was done by (...). So this is how I think it happened. One: by engaging the legitimate partners, RAB research, producing such results and 'TWO' by using the results that already had been generated by other countries, especially countries where Rwanda failed in more or less similar conditions (like Burundi).
Eva: Okay. So, can you just go to RAB and tell them 'I have a great idea' or how it this facilitated, this interaction.
CIALCA_researcher1: No you...of course it starts with a memorandum of understanding. When the project is being written you have partner's euhm, these Belgium funded projects with southern partners so you have partners in each of the country they going to be like the main partners that are implementing projects. So RAB from the beginning it was not RAB, it was ISAR.
Interviewer_EvS: Yeah.
CIALCA_researcher1: ...it was ISAR, It Is the institute that was going to work with the CG centres to do research so the legitimacy comes from the fact that yes we have agreed from the beginning that we are going to work together to generate results. These results will be used for development purposes. It was then RADA (Rwanda, Agricultural Board), the extension arm of RAB which became RAB (ISAR). So whatever information that we are going to produce and be taken out of extension in particular, so that starts in a memorandum of understanding that is signed

from the beginning. The of course you work on the terms you agree and not on the thing you don't agree but okay so you don't just go and say 'I have an idea'. You are working in that framework having a memorandum of understanding.

Interviewer_EvS: So there was already a partnership?

CIALCA_researcher1: There was already a partnership yes.

Eva: I can see. And if we would look at it from the other perspective. It might be a little difficult to imagine. If you look at the government how would you look at CIALCA and the way they try to reach legitimacy for their new idea?

CIALCA_researcher1: Now you want me to think like Rwanda government?

Interviewer_EvS: Yes.

CIALCA_researcher1: HAHA, now that's going to be difficult to think like Rwanda government because I am not sure how Rwanda government thinks. But in terms of legitimacy. One; it was engagement. Apart from the fact that this research was being done in collaboration with RAB, engagement was very key. There were some very key people. So that included the fact that the minister of agriculture that person who work with CG centres. Specifically IITA and the person who was head in RADA working on the banana side was also becoming known to us. So we kept on talking to them and engaging and explaining to them about all these benefits. These were then were the ones that were used as (...) explain (...) what they wanted to do to other. Yeah, Charles Murakezi who had worked with CIALCA from the beginning in Rwanda was very vital in making sure that the work we're doing moves ahead. Their strategy was capacity building. Capacity building, because some of the people that were students within CIALCA moved themselves in decision-making positions. For example Svetlana Gaidashova, who did here PhD with CIALCA became the head of banana program. Murakezi had moved then to the ministry was no longer in the banana program so that meant that for the banana-coffee intercropping already had somebody that knew this very well and could easily sell it. So it was engagement but also capacity building.

Interviewer_EvS: Yes, okay. I see. And, euhm, maybe difficult to remember but just really at the moment that things changed so these very few days. Was there anything that really pushed it. Did something happen.

CIALCA_researcher1. What moment are you referring to? What change are you talking about? We need to be on the same page.

Interviewer_EvS: Yeah, that policy was really adopted. The acceleration of the change was really speeding up in a way. So we just talked about a lot of things that were already in place so the engagement, capacity building, and partnership. Those were things that were in place. Would you say that the banana-coffee intercropping was a very incremental change or was there eventually a moment where things speeded up?

CIALCA_researcher1. It was incremental. It was pretty incremental. But of course in incremental there are also times were something happened and triggers things to move in an incremental manner but it's that particular moment what triggered things to move I think when I look back it is the results that Piet was presenting to the different stakeholders. They probably...I remember a meeting here in Kampala where Piet was talking to Murakezi on this subject. One particular day we were had come for a CIALCA meeting and he waited for a number of hours and he talked to her about the results that we had. So at the end of the day it was incremental but having results as evidence made real the case that were we advocating for much much faster. At least that was what was giving us our next appointment (engagement). Maybe somebody would not be interested but we no, we found out that if you intercrop this, you are getting this yield and making this more money. And like 'okay' at one moment she mentioned in a statement like "okay, now, I don't care whether people are intercropping or not intercropping as long as cup...coffee quality of Rwanda will not go down" So it was not an issue of intercropping, it was an issue of quality of the

coffee beans. But at the same time, during that very time when they had research going on that were done in different coffee farmers across Uganda to see doing to cup quality testing so we had results coming out. She actually made that statement when that results were coming out in less than a month and when those results came out they were send to show that actually the coffee quality increases. Because you are going to have bigger cherries for your coffee due to shade and cub quality and bean size are directly correlated. So having results and communicating them I think is something that helped us across the process but it was incremental kind of change

Interviewer_EvS: Okay, yeah. And, euhm, I have looked at CIP and it was a challenge. I thought it would be easier but when I was talking about what drove CIP and the role that CIALCA played in it I received very very diverse answers, so the people from CIALCA said that CIALCA played a big role in CIP, but RAB and extensionists and MINAGRI didn't mentioned CIALCA at all. So I could make very little conclusions out of that. I could also not really identify a nice case like banana-coffee intercropping case where institutional innovation happened (with CIALCA being a driver). Because people mentioned a lot different implementations that build up CIP like the land-use consolidation and distribution of fertilizer, so what I would like to know now is what are your ideas the influence of CIALCA in CIP. Did they use….

CIALCA_researcher1. None.

Interviewer_EvS: NONE? None at all, okay?

CIALCA_researcher1: Non. I think that CIP in something that emerged quite independently actually CIP is a bit contrary to what CIALCA was advocating in terms of systems research. It is euhm…don't use a small piece of land, people get together on one piece of land and don't do any kind of intercropping. Because euhm…if we are putting fertilizer on maize, were are putting fertilizer on maize. If we are putting fertilizer on potatoes we are putting it on potatoes. It was not intercropping at all. So there were some sections in CIP that are completely actually contrary to what CIALCA stood for. So in that case I don't see how one influenced the other, however CIALCA had a positive effect on CIP. They didn't have fertilizer recommendations at some point and they worked with CIALCA (partnership, capacity building). There was a student, I think he is currently doing his PhD probably, but he was doing his masters with euhm, RADA which now became like a fertilizer program on how to develop fertilizer recommendations for different crops for different areas in Rwanda. And I think that was a positive influence of CIALCA on CIP, generally. How much these results were used, I am really don't know but I know that the ministry was supporting that process and wanted to get results coming. So I see it that CIALCA jumping on a train that is already sort of moving rather than being the engineer that is driving the train.

Interviewer_EvS: So that can only seize some opportunities as soon as they open up. .

CIALCA_researcher1: That's was I believe.

Interviewer_EvS: Yeah

CIALCA_researcher1: I really.

Interviewer_EvS: That's sad. HAHA, I chose a little bit of a wrong institution to study. So they were mostly involved with the fertilizer recommendations?

CIALCA_researcher1: They are mostly involved with the fertilizer recommendations and of course with the whole probably CIP program but haven't been in touch to know how much it has changed because for me the biggest contribution of CIALCA on CIP would be for example that maybe it's not worth it to do only maize for smallholders. But if CIP is about, okay, lets consolidate land let's do one crop sometime against the will of some farmers that are in that program. And that is still on-going and that would never be a part of CIALCA recommendations. I wouldn't say that CIALCA really influenced CIP in that way.

Interviewer_EvS: Yeah, the only think that a they (participants) mentioned to me is that after a while CIP moved on and the productivity increased but that they had not really a market to

actually sell these new products and I heard from someone that CIALCA provided marketing training, so business plans. Do you know anything more about that.

CIALCA_researcher1: I know about CIALCA business plan, I think I conducted some.

Interviewer_EvS: Is this related to the productivity increase?

CIALCA_researcher1: In some cases, yes. And of course you may not target, in some areas you many not target the very crop that is under discussion but if you have members that have recommended land and have the skill they can also apply is for another crop but as far as I know the business plans that were done in Rwanda they were done in (location). And think they were largely banana farmers. And when were are talking about farmers producing…I think it was largely experience in the maize area. But yes, there were business plans trainings under CIALCA that happened that were advocating for collective marketing. Now that they changed the terrain for farmers that produced small (…) I don't know. I can't comment (incremental impact by partnerships)

Interviewer_EvS: Okay, no problem. That were the questions I wanted to ask for now. Maybe you have anything you want to tell me about institutional innovation in general in your experience. That I still need to know. No?

CIALCA_researcher1: Unless if there is anything more you want to ask that will still be fine. Euhm, I would want to know how you relate CIALCA with CIP. How did you relate CIALCA with CIP is it because of the time, the margin in Rwanda….

Interviewer_EvS: Euhm, well I asked in interviews just questions about what they know about CIALCA and what was going on in Rwanda and what were institutional innovation. And more or less, CIP emerged from that, most of the people I talked with were talking about CIP or things that related to CIP and related to CIALCA so from the people that I interviewed in the first phase (not so many) I thought that CIALCA played a big role in CIP euhm…I heard things about…because CIP is not only maize it's also legumes for example and that CIALCA had the knowledge and a lot of knowledge that they build before CIP started and that CIP could use a lot of the knowledge that was generated by CIALCA. That was my idea at first. So that was how I came up to look at the case and I thought there would be more interaction between MINAGRI, RAB and CIALCA, on CIP.

CIALCA_researcher1: Yeah, in terms of influence, if we are not talking about coffee banana. CIP, euhm …CIALCA was working of course with CIAT and they had quite a number of varieties of beans they were giving out to different…now it under HarvestPlace (?) which still sits under CIAT but yes, they were quite a number of in terms of technologies varieties that were given out most likely those helped different farmers out there but can't confidently comment on these varieties because there were under CIAT and I was under IITA and we were mainly looking at banana while CIAT was looking at beans. So for me whether its fertilizer, whether its banana, banana planting material, whether its bean varieties I see CIALCA contributing to a process that was on-going rather than being a part of setting. Did you try to see when CIP came up and when CIALCA came up? In your literature review?

Interviewer_EvS: Euhm, CIP came up in 2007 and CIALCA was 2006 and 2005 if I am correct, and the preparations for CIP already start in 1999. Euhm, I didn't receive much data on that but at least everybody shared a common goal on battling poverty through agriculture and through agricultural productivity, that is the main motivation for of actually everybody I spoke to. They said this was completely logic. Euhm and before 2007 there were actually very little institutions in place so CIP as I see it one big institutional innovation they are building lots and lots of rules and regulations, systems, so it's actually a very great example of how you have a big institutional innovation and how all these little steps actually requires changes and innovations. Euhm and yeah, knowledge is one of them and I think that's mainly the contribution of CIALCA, that is as far as I have heard. Some said that CIALCA was a pioneer so there were…I think now when talking to you, it is mostly a combination of being a pioneer with knowledge but also already being a

partner. Euhm, that is of course a big advantage. But it's probably, if its knowledge and you work close together with a partner like RAB or ISAR it's difficult to say where your influence was, maybe. Because you will probably discuss a lot and have a lot of meetings, a lot of discussion on what to do and then I think it's difficult to remember still what was really actually OUR contribution. Not just this big body of...partnership start to blend memory. The partnership start to diffuse ideas during workshops and meeting, so tracing CIALCA contribution becomes really hard. Unless you start to record the meeting and keep a clear record of the process. However, this might undermine the partnership because you are working from a perspective that you are different entities that have to claim their contribution to funders. So having to account for impact or success on an institutional level is possible, but is it something you should want? Funder believe there is a traceable impact in an institutional level, I believe this is most cases on incremental institutional innovation is not possible.

CIALCA_researcher1: (...) for CIP it was not largely implemented by RAB even...

Interviewer_EvS: Oh? Okay?

CIALCA_researcher1: Yeah, RAB had some contributions indeed but it was largely implemented by what was ISAR at that time what was done by the extension part, the extension arm of RAB and by that time they were completely separated. Which was RADA. So, we want this seed for here, we want this seed for here, so as we talk right now we can discuss RAB and talk about RAB at the beginning of it which is 2006-2007 what we are talking about is 2008...it was largely RADA and ISAR, ISAR was completely not into extension and RADA was completely...what this amount of seed we are talking to these people and they are working with the people in the districts to have this implemented. So when we talk about discussions here...(points at drawing)

Interviewer_EvS: Euhm yeah because CIALCA was then on this side (RADA) probably?

CIALCA_researcher1: Yes. Also strongly with this (ISAR) side as well.

Interviewer_EvS: Okay

CIALCA_researcher1: Yes as well with this. Because this is where I was tell you what RADA is where Murakezi was seated by that time and we worked with them to develop different things. We actually got staff that was base here we recruited staff that was sitting here, the extension arm.

Interviewer_EvS: Did they ask for that?

CIALCA_researcher1: Yes.

Interviewer_EvS: They actively came to CIALCA to ask for...

CIALCA_researcher1: Yes.

Interviewer_EvS:...advise.

CIALCA_researcher1: As part she was part of that advise body...she was Noella. Actually it would be nice to talk to her one time.

Interviewer_EvS: Noëlla?

CIALCA_researcher1: But she is now in China?

Interviewer_EvS: Maybe I can ask her by email.

CIALCA_researcher1: So all the technologies were developing materials that were sharing videos, facts sheets and she was in charge of it and it was sitting the extension part of it

Interviewer_EvS: Yes, so before with CIP it was mostly MINAGRI who created more or less the idea and gave incentives to the extension but there was not so much interaction with ISAR?

CIALCA_researcher1: There was interaction with ISAR because as you know we are talking about technologies for farmers to manage. But in terms of decision making...

Interviewer_EvS: Ahhh...

CIALCA_researcher1: Yes...looking at it that way. Actually what happened even unless what really happened with RAB because by the end of the day when RAB was formed, research went almost completely down. Everything was development, development, development. And the legitimacy part of it depended on where you are. If the government is very strong they are going to push

some things very strongly and they are not so much into developing technologies, so that's why I am saying they had a contribution but I am sure that was very weak. Which varieties do we have, what do we not have. Lets get it from Uganda and do it. So it was largely extension, implementing ideas coming from RAB.

Interviewer_EvS: So their role was more or less only advisor?

CIALCA_researcher1: Advisory, yes.

Interviewer_EvS: Euhm, do you perhaps know why ISAR and RADA became RAB?

CIALCA_researcher1: They wanted to have reduced hierarchies; they wanted to have 1 body where extension and research are going to the field at one time. Across Africa there was a feeling of that you have research but most of the time it doesn't go out into the field because they are sitting in different places. So they go to one place, situated in one body (establishing networks, avoid homogeneity). There was a deputy DG for research there was a deputy DG for extension and even for mechanization but nothing much was being done here (field?). All researchers, including even (Svetlana) became extension worked and the preferred it to (...)

Interviewer_EvS: AH, I see. Okay. How can I contact Noella.

CIALCA_researcher1: I will give you her contacts. She was sitting her with Charles Murakezi. I think that is quite important. It goes back to how legitimacy probably came. With the CIALCA staff but sitting within a legitimate institution if I may say so. Sitting within RADA and doing CIALCA work. She was part of the staff so we became part of RADA by that time, through her. Whatever we wanted was being done by her and life became easy. Knowledge and everything came from CIALCA. Knowledge and everything also came to her and she was going to different parts of the country. It was like that; she was there, doing work. So it was part of what probably legitimized the process.

Interviewer_EvS: Yes exactly.

CIALCA_researcher1: Rather than engaging but having stuff that is embedded within the local extension system also. Give us a (...) RADA. So this is it. I come back to it because this for me is what I like. And euhm, yeah, so in the work that we did I think the policy change and whatever is happening I haven't look back and see what happened, because Piet was actually responsible the (...) responsible for the engagement, but is has a greater effect when we went back, I had an opportunity to go back with Julia (Ekong). I think you got her report. Where farmers could freely learn and RAB is also planting in different trails there is even an area where they have planted so many acres of coffee and. So while maybe it's not yet written on paper it is an innovation that means so much for so many thousands of farmers who are limited by land. Even having this policy hindering them to really do what is logic. So I would want to see how it later turned out.

Interviewer_EvS: Yeah

CIALCA_researcher1: because the turning point showed that if you do this, this is what happened. This is what you get, this is what you get. And there are problems because still you have coffee people and you have banana-people and the coffee people have their own mandates. We didn't go as far as we would probably could have gone in terms of changing the policy and changing things.

Interviewer_EvS: Okay?

CIALCA_researcher1: Because the coffee people still only wanted to have coffee planted on a certain acreage in the country and they fear that if people are given an opportunity to intercrop they will be reducing coffee planting by planting banana's. Rather than going into banana areas that was also putting their coffee. So still there is (opportunity) for innovations and they still find these problems. They cannot take off because it's my responsibility it is my mandate (shows the importance of engagement, networks and participation). I am supposed to achieve this. What that means for the whole country or the farmers that are doing this, this is not really looked at. They are just protecting their portfolio. They are supposed to do this and they do it. And if other people are making cloths...they are making cloths. They don't care. But by the end of the day I am excited

about the work with this there it very much shaped our work, the work of IITA Uganda, engaging policy makers, intercropping being, research it all started with CIALCA. Piet was working on it as well and it has defined our work and way we are working. So it's about producing this and using the results to engage the out scaling partners and then see. So it is very much a defining chapter.
Interviewer_EvS: Yes, I notice that when talking to people. Euhm, on small question is it true that within this different environment so let's say also the government that there are a lot of working groups specifically for a crop? The coffee group and the banana working group?
CIALCA_researcher1: Yes
Interviewer_EvS: There is little interaction between them?
CIALCA_researcher1: Yes, very little interaction. You have a coffee crop for example sitting here and the another group sitting there but is was also the research that was done here that got them to start talking and considering. But things are still very much a work plan all still very much separate. So much time they don't talk.
Interviewer_EvS: Is that related to culture? Or is that just related to that the government finds this easy to manage?
CIALCA_researcher1: No it's is not related to culture, it is related to the history. And the current government has currently not done much. For example, coffee was giving priority in nearly all of these countries, all of them because it was a colonial crop, they liked it , they used it, they're exporting it. So they think nothing should be mixed with coffee. The banana program is still very young, it is coming up but it's still newly build. But the coffee problem was there, so it was kind of special.
Interviewer_EvS: Yes, and already maybe quite established?
CIALCA_researcher1: Already established. Define the stage of actors and stakeholders very well). So that also has to do with the fact that there is no plan in probably seeing it that this should be integrated it worked best for people who are working in these different groups. Especially if they want to become small kings. Within these groups (...) for having credits. For the moment now if you bring them together if we are talking about two directors maybe talking to the one and then the other one is easily (... related to organizational structures). So it's part of institutional integration that has to help them, what do we want to achieve and how do we want to achieve it. There were certain key sectors, it was coffee it was tea it was cotton. There was certain research on that. Even 'kawanda' that is a research institution for cotton. The research was really on those main crops. And still, even up to now you have people that don't fund some crops.
Interviewer_EvS: And you think this is strongly related to the history, so these institutions are longer established then the other ones.
CIALCA_researcher1: No, not necessarily, it is related to the history in a sense that these ones were separately build but is also very much related to the present that there is no will to bring them together which makes the most sense. And everyone would be trying to say; no were are an institution we should be recognized as an institutions but usually the motivations are very different. Very (crude). So you have everybody wanting to...yeah if people are working for salaries different (...) to have influence and use the money. It is also different, you plan differently. They will plan and accept things differently and I think that is still at the issue; that there is no strategic plan from up that sees the need for this different organizations to work together. And I think that is the innovation that we were seeing in Rwanda, because even here there is a lot of research that still does not go...not reach extension because extension is separated from research, there are not necessarily talking, they don't even necessarily want to talk. Everybody is protecting their mandate and they manage that mandate, they are better off like that.
Interviewer_EvS: So would you say then that the crop intensification program is an attempt to bring different fields together?.

CIALCA_researcher1: I wouldn't say so. I would say that the coming up of RAB is such an attempt is such an attempt. The crop intensification program I think has also had the right motivation as well in terms of what is the minimum you need for meaningful production if everybody, if you have, if you living the country where the land is small and everybody has a small piece and everybody is deciding what they are going to grow. So how do you get your margins? As a country? How do you plan, that is difficult. Is can be difficult to plan. Because in the course of doing that you find that you are not maybe as prepared and ready for (...), the storage is not very well adapted or the marketing is not prepared for but by the end of the day you have productivity that is coming but that is not necessarily related to profitability.

C.2 Interview CIALCA researcher 2 about achieving legitimacy (from CIALCA to Government) for a new idea/innovation.

Date: 24 October 2015
Location: Skype

Interviewer_EvS: first question. I am looking now at institutional innovation specially through certain words. And one of the most important words I like to know more about is legitimacy (explain in thesis why this word is important). Because if the stakeholders feel that a new idea is legitimate there is a bigger change that a certain innovation can be made. So what I would like to know first is how did CIALCA achieve legitimacy in their innovation for banana coffee intercropping.

CIALCA_researcher2: okay, but you want to...let me let me try to understand this at least for myself, you know. Legitimacy. You want talk about the legitimacy of the innovation or the legitimacy of the institutions or the legitimacy of the process...

Interviewer_EvS: ...the legitimacy of the process. So CIALCA had probably a way to make sure that their banana-coffee intercropping idea or innovation was perceived legitimate by the government.

CIALCA_researcher2: okay, well you know it was just lots of data of course. So what happened was that we had first in 2006 we started with some on farm trails, measurement work on the program of USAID that looked at bananas and fertilizer of banana's. But they did also some work on coffee. And then the guy who was responsible for coffee said "Hey, you also have to work on coffee". And I said: "No, we don't work on coffee." "Yeah, but there are lots of banana's in coffee." And I said "Fine, we are going to do it, but we will do it was follows. We will monitor some of the coffee plots, fertilize and unfertilized, some of the banana plots, fertilize and unfertilized and then some of the banana coffee intercropping plots and fertilize and unfertilized. And they said 'that's fine'. And we got a little bit of money not much, but anyway. We monitored, what was it? I think a few hundred plots. In the end it was six categories: coffee plots, fertilize and unfertilized, banana plots, fertilize and unfertilized, banana coffee intercropping plots and fertilize and unfertilized. In total I think we had about 200 plots. Or maybe it was a bit more, 300. Anyway we did that work. And then of course we saw to our own surprise that banana coffee intercropping plots always had the same coffee yield, there was no significant different coffee yield. And, but it terms...the banana yield were also quite good. And it terms of total productivity these banana coffee intercropping field were doing much better, fertilized and unfertilized. And euh...this was one study. There was another USAID program that came later. "That's nice, we want to do this...we want to scale this out." And we were like; "Yeah, but we only did this in 3 districts and in Robusta and Arabica. So in the end, you know, we said we have not been in the other areas of the country. It was actually in 3 regions. It was the south west, the south and the east. We didn't have the west, we didn't have the north, we didn't have north-west. So then we have a following up project, where we had to look more at soil fertility and coffee, we used that also, you know, to at least compare coffee mono-cropping to coffee with banana's. [...] measurements on banana's and again we went to the whole country. In dry area's you know, more arid areas, the west, the far south west the high lands. We went to the west of Kasise and the Ruwenzori mountains. So everywhere we started to measure yields in coffee plots and take nutrient status but also take measurements of the banana intercrops and then compare whether the coffee monocrop was better or worse than the intercropped ones. And we found the same story. And now I think it was 357 samples in total. We had again see that no matter in which environment you are operating the intercropping was always more profitable. Then we went to....after this we also went to Burundi. 'Shall we do banana-coffee intercropping?' Because Burundi is the number 1 export crop. (...) 70% of the export. The revenue depends a bit on the year because... (...) and of course they also have a lot of

banana's so…'wow this could be really interesting for Burundi'. And of course the Burundi researchers and national research organizations were a bit hesitant but after some persuasion we said we can give a PhD student an opportunity to learn on this and do trials and…euh…we will have to do these trials. And they said 'Fine, you can do this banana-coffee intercropping but not on the farmers field because we need may just already promote intercropping while we actually are still doing research. And if the government organization like us is doing trails on farms, you know, intercropping then obviously it looks like we are already promoting it. So we were allowed to do some trails in two different environments. In very poor fertility soil and in higher and medium altitude, slightly better soil. And we had 3 coffee densities and banana densities and basically mixed (…) designs so to have every different combination of coffee-banana densities was made. So it was repeated a few times per side and also across two sides. In the end again, even there, consistently we found banana-coffee intercropping was yielding much more result and also often, you know, did not negatively affect the coffee yield, only at very high banana densities we saw that there was a slight negative impact of bananas on the coffee. But the (increment) of the total revenue of the much higher density of banana is still much larger. So whatever, you know, in terms of the recommendations you would almost say to maximize the benefit of the farmer you maximize almost banana and coffee density and then both crops would suffer a bit, but at least you know you maximize your income. But most of the farmers work at lower densities. And at these densities the competition of bananas and coffee is still not so big. And the two crops work happily together. So this was all the agronomic data. So in 2013 I went to see the minister in Rwanda. Because I already talked to the Rwanda…actually no, what happened after we got the results, in 2011 I think or 12. Even RAB, the Rwandan government scientific institute set up their own trial in the east of the country, banana coffee intercropping trials. Without notifying us, without asking out about the protocol…but it really showed that they themselves interested in this study.

Interviewer_EvS: Okay, did they receive that information already from CIALCA or not. Was this completely…

CIALCA_researcher2: From CIALCA ja, through the workshop that we had, you know. We had a workshop that reported on these things. So for sure they were getting it from us. Whether directly or indirectly they had heard about it. And then they started to set up their own trials with their own funding in their own location and their own protocol. But the protocol was not so different from what we had done. It was in the east of the country and then we basically said 'oh, that is nice, but we should do a survey. And then we actually did a survey in Rwanda, also because in some areas if you look far enough you will see some banana in coffee. So we said let's look at the banana coffee intercrop plots and the monocrop ones. And even that, we had an MSc student who showed that there was little difference between monocropping and intercropping in terms of coffee yield. Anyway, so we had a pretty solid evidence base. And then already the national research became interested. That's when I basically went to the minister and I tried to reach her and I waited outside her door for 3 hours. And after she said 'Wow, Piet, you are still here?" And I said "Yeah, I am still here because I need 15 min with you." So she said "Fine, come in." So we came in showed her the research. And she said. "Yes, nice nice. I can see how it can be beneficial". We even talked also to the DG. He was Jean-Jacques, the DG. When we talked to him and a number of people but definitely also to the minister. (…) This was somewhere in 2012 maybe…. And then, euhm,…Oh at the end she (the minister) said at the end of the conversation she said; "Yeah, Piet, I like it I can see how it can be beneficial for the farmers but actually I don't really care…I actually don't really care about the total production, even if there would be a slightly negative impact on the coffee production by banana (…) that all accepted. But what is unacceptable is a decrease in coffee quality because in Rwanda we will not be able to expand our coffee production a lot, we are a small country there is only so much land. But what we can do is

we can be much better, you know at improving our quality and get a high quality price on the world market. The way for example how Kenya does it and some of the fine coffees of Colombia. So in the end, you know they a want to be sure that the coffee quality. So she said, Yeah Piet, it's all nice but I have to know whether the coffee quality will not be affected. So, okay okay thanks for the audience. And then we actually had to get back to get coffee quality mapping survey in Uganda. And there it was cup quality, so everybody tastes the coffee and scores it (…). So our national survey we did at coffee (…) were all cut and we looked at of course soil fertility and whether the coffee was shaded enough. So in the end what we found was that when there was banana intercropping in the coffee, the coffee was never negatively affected and in some cases positively affected. So we were quite happy of course, we could tell the minister that….of course from the Ugandan data we could show that if anything could happen it wouldn't be negatively affected, the coffee yield I mean coffee quality. So I went to her, I made an appointment and explained it. She said, yes of course! I said, what of course? She said Yeah, it's is known already from several studies that shaded coffee has better coffee quality. But anyway, she needed to have that evidence before you can make choice you have to say that you are going to do maybe…..she also wanted to be comforted. She knew that we had all the evidence to back up decisions she would make. And she needed that to back it up. So she said: no let's see what we can do. We can organize a sector meeting I will ask the whole coffee sector the come I will ask NGO's to come and you can present you results and we will ask farmer representatives to come and we can present your results and we are going to give feedback on banana coffee intercropping. So we did that in March 2013 we organized that meeting on these NGO's and the minister. Well, the minister would be there but in the end she was called by the president and had to go and see the president. Of course delegates you know official representatives from the government, but she herself couldn't be there. We had (bbC) Belgian cooperation there, we had a lot of people. It was an interesting day and the outcome was basically that….you know we were even bringing in the climate change perspective. When you have banana coffee intercropping you are less exposed to climate shocks. Even already Laurence did a study on perception of banana coffee intercropping. What farmers think about it what industry actors thought about it. And then of course she saw that farmers appreciate it with respect to climate shocks or change it was something that was mentioned that shaded coffee by banana was a little bit less sensitive to drought. This was just…we had it on measurements, you know. This was just people's opinions. So basically then we organized this meeting and the farmers were very supportive in the findings. The NGO's were very supportive only they had the head of the coffee authority (who was the former research who installed himself the coffee banana intercrop trial in Rwanda (Celestin) was now the head of the export, he was responsible for the coffee export of the government. He said 'Yeah, well its nice. It looks good. But you know we still have to validate this from Uganda to Rwanda. We don't know if we can go to large scale and this and that. And later on you know we asked the indirectly you know, Is think it was Perez who asked it: 'This was forbidden right? (the intercropping). And then they would say "No it wasn't forbidden. There is no policy that forbids banana coffee intercropping. Having said that, it's not very true because the whole crop intensification program of course was based upon monocropping and improved varieties. So, they were also just that was a political statement, they never wanted to say that they were going to keep the farmers poor or keep the farmers away from good opportunities. So they would say; 'No no, we don't have a policy that states that. Yeah, that is true. It doesn't say it explicitly but indirectly. This is the consequence of the policy and the strategy that you have adopted. Anyway, at that time then it we decided that RAB would take it further and they would do more on-farm validation let's say a farmers field school program that they were doing throughout the country. With (NAME) he was a scientist and he laid out in their emails that they were now testing …Now I just talked last week to Celestine so the one who is of coffee…who is responsible in the government for the coffee export. And I said "Celestine, how is it

now. Are you now promoting it? He said "No no, we still having the validation work on (both?) And trail also that (IITA?) told 4 years ago and we are still looking at the results. But he said but what we have no longer done is that in the past we would tell people not to do it (intercropping) and if we would see it…then we would be taking measures to make sure that it wouldn't happen. And now, he said, if we see it, we tolerate it. We allow it. Which of course also means that farmers themselves also will see that it is being allowed and they will slowly see that 'hey, it is not being stopped'. Of course we had some of the farmer representatives in the meeting what was in march…and then later on earlier this year. In May or something Julia Ekong went to Rwanda to check for CICAFS, what is the status of this potential policy change and she basically also….you also read the document right? …in which she then describes also. The people are now recognizing it, they know about it and they also see the benefits nobody is against it but there is no official policy now that promotes it. So she said you have to go and promote it now so make it into a policy. So I think she was too hard at saying that it should be a policy. Because I have a feeling that what we have achieved already, that there is a change in mentality and people are talking about it, it is happening everywhere. But we didn't turn it into a policy. CICAFS was very keen to really see a policy change document changes. So what basically we have in Rwanda is we have a very strong change of the attitude and the knowledge around these systems (about coffee banana intercropping) and then we have also seen a subsequently change in discourse. So you can go to the coffee export and you can go the government and then you will hear that people will actually talk positively about it. But nobody has submitted a law. And the parliament. Is And now … we have to promote banana-coffee intercropping. So anyway, I don't know whether it is needed. It is not my top priority. Anyway, then maybe the whole explanation of the history explains how we got to some degree of legitimacy.

Interviewer_EvS: yes, so legitimacy is especially achieved by evidence?

CIALCA_researcher2: Oh, yes, So let's see if you put it like this. The farmers had a good gut feeling. So maybe the legitimacy of the farmers in terms of them being convinced that it worked. What we noticed during the workshop that the few farmers who had experience with it particularly in Rwanda and in the east of Rwanda, we have a number of farmers who came back after the genocide…or the genocide before that. They have been living or their parents have been living in Uganda. They had seen in these countries where banana coffee intercropping and they had taking it to the east of Rwanda. So although it was a policy that was not allowed some limited areas, you know, in the east of Rwanda,…if you would go away from the road you would already see a bit of banana coffee intercropping. I think for the farmers, there was already quite a number of them who were quite convinced it would work. So the problem was much more, of course, the midlevel people. They don't have so much experience and they felt a bit insecure about it, so trying it, promoting it, it wasn't possible. And then of course only when the top management have organized a meeting and called all these people and made a MINAGRI newsletter you can download it but anyway then finally in the end they said…also in the newsletter, no talks about the change of the way how Rwanda ministry may take on agriculture…to the ability to take on intercropping. But it was only when the minister and the government that organized the meeting around it and basically gave a sign of approval, that there was a change of discourse of midlevel people. Much more tolerant and validation taking place. But I have not been tracking that validation to be honest.

Interviewer_EvS: Yeah, but does that mean that the evidence for farmer is very convincing but is evidence also convincing enough for the government? Does the government need anything else?

CIALCA_researcher2: I don't know. Maybe they want to make it an official strategy, or they want to have something else. I don't know. I mean this what they said in 2013 what Celestine, head of the export now said 'now we are tolerating it but we are not actively disseminating it. We are tolerating it and more people are doing it. So he was saying that there was a change. And I said

'Well, why do you not actively promote it?" He said "well, you know, we still have our trails and still want to see the results." Even though there was so much convincing evidence everywhere there is always that little bit of fear, you know, the country is so much depending on a few export crops that they are fearful that If you would now go ahead and promote it that would could go from a coffee plantation to a coffee-banana plantation, and from a coffee-banana plantation you would move to a banana plantation. Because you would maybe make more profit from that. In the end, since it has always been a government crop more or less which has not always been as profitable as the other crops they always have this fear that when you allow…when you don't tell the farmers to do this anymore that farmers may just be slowly transitioning and kicking out coffee. So as the coffee authorities… This is also what we saw in Uganda. Coffee research and the coffee authority and everything. They have been given lip service about…here in Uganda…about coffee banana intercropping, that it is nice, but nobody has been actively promoting it. But also because in the end it is not directly in the interest, the research shows that if we would do this, the farmer will not produce more coffee. The yield stays the same. Maybe sometimes a little bit more, or a little bit less or that is depends on the climate shock, no impact on coffee quality or just a slight positive effect. But there is no big incentive for them to say "Wow, lets embrace this technology. Let's get it out. Because it will not generate them that much benefits as it would generate…that was the paper that Laurence wrote….did you see it, on perceptions on banana-coffee intercropping?

Interviewer_EvS: No, I don't think I have seen it.

CIALCA_researcher2: Let me drop it to you. …Wacht even. (Just er tussen door)…..Pauze (uitwisseling van document)….Ja, waarom is er geen outscale of adoption dan zie je duidelijk dat de incentives voor de coffee sector zelf helemaal niet zo groot zijn.

Interviewer_EvS: Ja, maar dat betekend dan dus eigenlijk dat legimacy niet alleen maar afhangt van bewijs. Dus.

CIALCA_researcher2: Euh, nee, maar dus ook van institutional mandate of van institutional interests.

Interviewer_EvS: En hoe zou dat beïnvloedbaar kunnen zijn? Volgens jou ervaring?

CIALCA_researcher2: Wacht even, ik probeer te multitasken maar dat lukt niet (PAUZE). Nou goed, ze moeten daarbij ook ownership hebben. Dus daarom hebben we met Rwanda samengewerkt door samen met RAB onderzoekers. (…) We hebben dus een quick survey gedaan naar banana-coffee intercropping status en yields. Dat hebben we samen met RAB gedaan. Wat we ook hebben gedaan is. We hebben RAB en ook bijvoorbeeld Starbucks of wie was het ook al weer…ja het was Starbucks…we hebben twee drie mensen van de coffee sector van Rwanda en Burundi uitgenodigd naar Uganda, naar het zuidwesten waar veel Arabica was en waar bananen groeien. Dus we hebben ze naar Uganda gebracht om te laten zien hoe banana-coffee intercropping eruit zag zodat het niet alleen data was, maar dat ze ook zagen hoe die banana-coffee systemen er uit zagen. En dat hebben ze gedaan en de Burundezen hebben zeggen nog van dat bezoek trouwens: 'het ziet er ongelofelijk goed uit' maar ze zeiden Ja…ons probleem in Burundi is dat als wij zeggen dat we banana-coffee mogen doen en dat kunnen wij helemaal niet goed managen als de Rwandezen. Die gaan dat vol zetten met bananen en die koffie gaat er gewoon uit. Ook in Burundi dus is er voor onderzoek is er voor de private sector dus een beetje een krampachtige houding omdat koffie altijd een beetje een state-owned crop is geweest. Er is een koffie autoriteit en de het is de coffee autoriteit die de prijs bepaald en die inputs gaven en die ze vertelde hoe ze het moeten doen, hoeveel land boeren nodig zouden hebben. Het is altijd heel erg door de staat bepaald. En na 50-60 jaar is dat heel moeilijk voor die mensen om dat model te veranderen en boeren zelf te laten beslissen. Daarmee hebben zij het idee dat de als je het de boeren toestaat, ja, dan gaat die koffie er direct uit. Die zijn dat gewoon een beetje zat, maar ook omdat zij nooit bezig zijn geweest om te proberen die ownership te creëren voor die boeren voor koffie en

bananen. Zij zijn gewoon bezig om te zorgen dat die boeren koffie produceren. Dus die geschiedenis zal ik maar zeggen zorgt ervoor dat ze zo krampachtig zijn tegen over die technology. Niet omdat zij niet geloven in die agronomie maar omdat zij geloven dat de boeren zelf zo weinig zin hebben in koffie dat ieder alternatief dat word geboden direct wordt aangegrepen en dat de weg is…dat dit het einde betekend van de koffie.

Interviewer_EvS: Ja, hebben ze daar enigszins gelijk in. Of niet? Zijn boeren het inderdaad zat om koffie te groeien?

CIALCA_researcher2: Ja, ik denk het wel. Zeker als het niet begeleid wordt, weet je.

Interviewer_EvS: Dan ga ik even naar de volgende vraag: van mijn interview, want ik kijk naar twee cases. Dus ik kijk naar de bananen koffie intercropping maar ik kijk ook naar de Crop Intensification Program in Rwanda. Dat is natuurlijk een vele malen grotere verandering dan koffie intercropping is geweest. Maar ik vroeg me af heeft CIALCA enigszins invloed gehad op dat programma?

CIALCA_researcher2: Nee, ik denk niet veel. Ze hebben misschien ideetjes gepakt en technologieën. Dat zou kunnen maar de strategie achter dat CIP ik denk niet dat CIALCA daar iets of veel aan gedaan heeft. We hebben dat nooit bewust gedaan het zou kunnen dan mensen ideeën hebben opgedaan links of rechts en daar op hebben ingezet maar nee en wij waren ook helemaal niet zo'n voorstanders van monocropping en land consolidation en green revolution. Nou, green revolution fine maar dan wel adapted to farmers conditions. Terwijl CIP is heel erg lineair weet je wel traditioneel in zijn approach.

Interviewer_EvS: Ja, dat klopt. Ja. Zij hebben zo ver ik weet CIALCA staat dicht bij RAB of degene die daarvoor waren dus ISAR en RADA Denk je dat ze misschien op een minder zichtbare manier invloed kunnen hebben gehad?

CIALCA_researcher2: Dat we ze op een minder zichtbare manier hebben beïnvloed?

Interviewer_EvS: Ja. Misschien wat minder duidelijk uitgesproken maar…ik heb toch een beetje het idee dat…

CIALCA_researcher2: Hypothetisch ja. Ja, je bent scientist, dus ik houd niet zo van speculeren. Ja misschien wel…maar het kan ook net zo goed zijn dat het niet zo is.

Interviewer_EvS: Okay, wat ja goed. Het CIP programma

CIALCA_researcher2: Nee we hebben geen invloed gehad. Maar als we een beetje enthousiast….misschien wat wel was is dat CIALCA bezig was met intensificatie technologieën en daar misschien wat gegevens en verhalen over kwamen. Hey wij zijn daar mee bezig, ze zijn met fertilizer bezig, met nieuwe varieties bezig, misschien dat er goede verhalen over kwamen. Dat de regering misschien daardoor dacht van…zie je als je intensificatie doet, dan krijg je meer opbrengst, wij willen meer opbrengst dus we moeten dat ook doen… maar iedereen die een beetje landbouw opleiding heeft gehad in het buitenland weet ook wel hoe dat ging. Dus ik denk niet dat dat later ter plekke….iets meer enthousiasme…but allows the to create a bit more (…) you know for that agenda. But I wouldn't say that we were the ones that were driving the process or influencing in any conscious way.

Interviewer_EvS: Okay but then how would you describe the partnership that CIALCA had with ISAR, RADA and later on RAB?

CIALCA_researcher2: Well you know, it has always been a bit like we can't work in these countries without working with them as partners. We don't have a legitimate mandate the moral mandate to work in farmers' fields and … (our demands?). And CGR is often considered an organization that is there you know to help…to do innovative science but also to support building capacity. We were doing that, we were having PhD's. Euh…we had two PhD's in CIALCA. Euh, and we brought in a new external…we brought a scientist into Rwanda. That scientist Charles Murakezi is now responsible for everything with fertilizers and intensification. I've not been talking to him in a long

time… So you know we…and we had some old colleagues as well…but I mean basically the mutual benefit was that we were getting of course access to partners on the ground, to mandate you know that ISAR had and they would be getting access to technologies and opportunities for them to train staff, MScs and PhDs

Interviewer_EvS; Yes, that was part of the organizational mandate? That CIALCA would train people?

CIALCA_researcher2: Yes, yes, it was part of the activities … like Telesphore. Did you talk to him?

Interviewer_EvS: Yes I did.

CIALCA_researcher2: Sorry?

Interviewer_EvS: I did talk to him.

CIALCA_researcher2: He was an PhD student you know. AH we had 3 PhD students, I think we had 3. One was of bioversity, one of IITA, CIAT and… so they are now all in high positions at that time is was little capacity building within that national organization it was still limited but it was there. So this was a mutual beneficial relationship.

Interviewer_EvS: Okay, if I ask a bit of a sneaky question. Was training the staff also something strategic for CIALCA.

CIALCA_researcher2: It has much more to do with the strategic management, meaning that what you see it that we also heir research assistants and these kind of things, but that never worked, they were always doing lots of things. Left and right but they were not committed. They were not getting the science out. We want to have science. So PhD student were in our own interest, they would be committed people, the would… they would take responsibility that would drive the process forward. And me of course located in Uganda and Congo was nice, but you know I wasn't next to them. I wasn't able to respond myself. So PdH students were just a perfect solution, we got high quality science output and cheap and committed labor if I say it very blunt.

Interviewer_EvS: But for achieving institutional innovation it was not really a strategic move of CIALCA to train staff?

CIALCA_researcher2: We had always put this in the program proposal as well. It was part of it, yes. Rwanda also asked for it, ISAR asked if we wanted to train staff. So yeah it fitted our … Yes, it was part of our strategy it was demanded by the partners and we could supply is and it would help us to implement better. So it was a win win win.

Interviewer_EvS: Yes indeed. So that is good, that is nice to hear. The next two questions that I had…Did the merge of RADA and ISAR into RAB had any consequences for CIALCA?

CIALCA_researcher2: Not directly in the beginning but what we did notice that the scientists that we were working with, now suddenly had to go and do a lot of work related to extension and do a lot more extension related activities and making sure that they were reaching their target. Yeah, I think that in the beginning of course leading to less commitment to our partnership with the scientists. I mean there were already a bit more then when we started but by the time that this transition took place and the national institution became more capacitated, you know they had a stronger agenda, they had more money…so we also became less of a single lead organization. We were not before, but you know there were fewer projects and fewer resources. And there was more attention or focus on our work but then of course…as that also slowly decreased a little bit and then of course the transition with RAB you saw people just running left and right to reach their targets for the government. And they were sometimes not committed. Not as available, you know to science…

Interviewer_EvS: Yes, I get it. So did it become harder for CIALCA to reach legitimacy for research results and innovations?

CIALCA_researcher2: When was the transition of RAB. I think it was in 5 years ago?

Interviewer_EvS: I wrote it down somewhere, but I can't remember it.

CIALCA_researcher2: I mean, by that time we were also getting to the end of our CIALCA phase 2 and we were now going to transition into HumidTropics, but then officially 1 and a half years there was talk about Humidtropics starting and it started and it didn't start and we were waiting and we now had less budget you know, we were depending and PhD students were finishing. So the project itself at that time was a bit in a dip, you know. The resource availability, the people that were there, the total number of energy...and then of course at the same time the transition of RAB was also taking place so that all didn't really help.
Interviewer_EvS: So okay, in the later stage there was not much...
CIALCA_researcher2: Yeah, there was still some collaboration with RAB. It was there. It was not bad. But it was not with the intensity as before
Interviewer_EvS: Alright. I think these were my questions...

C.3 Interview CIALCA researcher 3 about achieving legitimacy (from CIALCA to Government) for a new idea/innovation.

Date: 28 October
Location: Skype.

CIALCA_researcher3: For question one you ask how we achieve legitimacy in banana-coffee intercropping. Yeah, the government for farmers to intercrop coffee and banana does not yet approve this.
Interviewer_EvS: Okay?

CIALCA_researcher3: Not yet, yes. Farmers see reasons and they want to do that. But I think the reason for doing that are obvious.
Interviewer_EvS: So it's obvious for the...because it is useful? Or?
CIALCA_researcher3: You know, in the past they were doing monocropping for coffee. Reasons be that for coffee, coffee lucrative prices. People know that the price of coffee is so high, it is a cash crop and they have sufficient land where they could grow coffee and grow food crop alternatively or elsewhere. Those are the reasons. It happens in my own country where farmers (contemplation) was small they could contribute cash crop on separate land and grow food crop on separate land.
Interviewer_EvS: Okay
CIALCA_researcher3: So given the problem of land scarcity and no price, coffee price is, they are thinking of (switching) to food crops. The would easily welcome or embrace integration of food crops into their coffee. Because coffee doesn't make money as they are used too in the past.
Interviewer_EvS: Ah, I see.
CIALCA_researcher3: So these are the reasons why they want to integrate... intercrop with bananas
Interviewer_EvS: But it is still not approved? So it is not completely legitimate yet? Or?
CIALCA_researcher3: Yeah, not yet legitimate. We have done a lot of advocacy. But there is no official documentation or request by the states for farmers to integrate this, bananas and coffee. You know, the government also want to put the coffee. It happens also in Burundi where coffee is seen as an cash crop and income generating activity for that states. Not for domestic use but for export markets so (...) to integrate bananas with coffee gradually coffee might disappear. Because you don't consume coffee. The price of coffee is lucrative. You cannot consume so the coffee is meant for export. They prefer to go for crops that they can easily make use of it. So those are the

reasons. The government is scared that if they authorize farmers to integrate bananas in coffee with time it will become a banana-farm.

Interviewer_EvS: I see, I understand. So that is why they are not really changing the policy officially yet.

CIALCA_researcher3: Yes

Interviewer_EvS: Yes Is there anything else needed. Is the government...do they want other research or...?

CIALCA_researcher3: You know, research has shown that intercropping banana's and coffee is profitable. But the reality on ground is that farmers do not consume coffee and do want to cultivate crops they can consume. So if they would go ahead to banana into coffee farms, then banana will become a major crop and coffee will become a subsidized crop. But they will give more attention to bananas and gradually all the coffee farms will be replaced by banana. Because they can eat banana, they can consume it.

Interviewer_EvS: Do you know if CIALCA addressed this issue? In their research or their advice? Or did they not know.

CIALCA_researcher3: No, what we had done research on that, it was probable. We had policy brief, we had everything, that it was profitable. But not everything that is profitable that is asserted by policy. Policy also have their own interests, with national (treats?). So these (treats?) countries are recognized by different crops that are export, that are for export markets. You don't like the quantity of exports, it creates drop. Because they integrate banana and coffee because farmers they let go coffee and go for banana..

Interviewer_EvS: I understand.

CIALCA_researcher3: So that is one of the challenges.

Interviewer_EvS: Okay, so then I will go to the second question. Do you know what the influence of CIALCA was on the Crop Intensification Program? Did they have any influence and what kind of influence was it?

CIALCA_researcher3: You know...the problem is communication. CIP doesn't mean monocropping. That is the way people interpret it. So when the policy came for CIP and example was given with monocrops so the association was that intensification means monocropping. So given that land area are small and accessible, after meeting with policy makers, after meetings they also said 'No it doesn't mean monocropping. It means putting the land into maximum use to generate more produce. So in any form we do this to generate more produce that is sustainable. So that is in term of intensification but it doesn't mean mono cropping. So, so order came in and dialog with the policy and they decided to do mono cropping, but we were doing mix cropping, the initial policy was (not) against mix cropping. But the communication was not clear. People interpreted it as mono cropping.

Interviewer_EvS: Okay.

CIALCA_researcher3: So the only thing we do, was to go to the policy and dialog with them and discover that it not essentially means mono-cropping, but to mix cropping. So we were saying we were doing mix cropping and farmer are (happy?)

Interviewer_EvS: Did that mean that miscommunication that CIALCA in the first place didn't want help out? Or?

CIALCA_researcher3: No, the government decided to orientate production into the CIP, that was the government policy. So in the CIP the communication to farmers was not clear. So farmers thought: CIP means monocropping. From the policy side not from the CIALCA side. Or which this was not the intention. The intention was to intensify production have good produce from a particular small piece of land and the land be sustainably managed

Interviewer_EvS: Yes.

CIALCA_researcher3: So we our approach which was mix cropping we thus came in and pass on the right communication to (...) farmers that is especially does not mean mono-cropping. So you can still mix your crops. (...) people think, people think that CIALCA (...) it was the government that complicated the work.

Interviewer_EvS: I see. And eum, CIP it has several parts. So it is about distribution of fertilizers and land use consolidation...

CIALCA_researcher3:...efficient use of the land you own because the land does not increase in size. So the objective is to put use of the land you own efficiently to maximize production in a sustainable manner. You cannot increase land so the little piece of land you have of how you thing of how you can maximize and generate more produce from that particular piece of land in a sustainable manner. So that is CIP

Interviewer_EvS: okay

CIALCA_researcher3:: So it was interpreted as mono-cropping . That was the case.

Interviewer_EvS: I understand. Do you know if CIALCA research has contributed to the new management practices and intensification?

CIALCA_researcher3: Yes, yes, our contribution is one two fold. We have appropriate crop combination. So, farmers will combine anything. So appropriate crop combination and special arrangement if you are combining the crops (...) so as appropriate combination as possible and special arrangement. So when you combine appropriately there are so many things you can increase, soil consolidation. For instance you take beans and cassava, with the technology that CIALCA introduced means you can grow beans twice in a cassava field before harvesting the cassava. And the beans provided the nutrients, soil nutrients and the farmers also make benefit of the produce in terms of rotation and income. Because you have the beans and cassava on the same piece of land

Interviewer_EvS: So they helped CIALCA research mainly contributed with these advises.

CIALCA_researcher3: Yes, appropriate combination.

Interviewer_EvS; Yeah.

CIALCA_researcher3: (...) they mix everything. And it creates competition.

Interviewer_EvS; between the plants or...

CIALCA_researcher3: between the plants. If you grow banana and cassava on the same piece of land you are exhausting the land in a very short time. Food crops they consume nutrients. So we just advice on appropriate combination as special arrangement. Want to plants cassava and beans, what special arrangements we advise to generate the same yield of cassava and the yield of beans. So that are the special arrangement of how the land should be arranged to generate to maximize profit.

Interviewer_EvS: And did CIALCA also help out with the advices on fertilizer?

CIALCA_researcher3: Yes yes, we were doing fertilizer recommendation micro doses because organic fertilizer is expensive, very expensive and scarce then on the other hand organic fertilizer also is so bulky to transport.

Interviewer_EvS: I didn't know that.

CIALCA_researcher3: Very bulky. You can go to a livestock farm to transport organic fertilizer (..) So we are going micro dose where we mix or organic and inorganic. Yes we mix organic and inorganic fertilizer to reduce the quantity of organic and inorganic. So it is a blend. It is a blend of organic and inorganic.

Interviewer_EvS; Okay interesting, and that is CIALCA research?

CIALCA_researcher3: Yeah.

Interviewer_EvS; Alright, okay I go to the third question that I have. So I am looking at all these changes and innovations from an institutional perspective. So I would like to ask you would you see some similarities in the process of Banana-coffee intercropping case and the CIP so from the

CIALCA point of view. Do you see any similarities in how they approached the government or RAB or…

CIALCA_researcher3: Yeah, the similarities is to maximize productivity and increase income. That is the similarity. It is to maximize productivity, increase income and then sustain natural resource management. As I explained earlier. Government doesn't want farmers to stop grow coffee, so they know, they know it is a good technology. They know that combining coffee and banana is productive will generate more revenue. But they are afraid that coffee will be moved from the system which is (…).

Interviewer_EvS; And euh how is the partnership which CIALCA and the government. How is it established? Is it a good partnership or are they part of a bigger whole?

CIALCA_researcher3: It is a very very good partnership. We have meetings with policy makers. And any time they then need us invite us and then we invite them to come and we share our problems to learn what is needed to and see what we can provide

Interviewer_EvS: So there is a similar discourse I mean…

CIALCA_researcher3: Yes, there is. You know, there are certain things that cannot afford. When we talk about banana diseases, cassava diseases (…) resistant planting material which is done at research centers between cross breeding's, improved varieties. Which is above the capacity of national systems. So we collaborate to see how it could develop the varieties.

Interviewer_EvS: Because I assume that they….

CIALCA_researcher3: …capacity. They have short-term and long-term training. We do organize group training, degree programs and group training for NGO's and farmers on improved technologies.

Interviewer_EvS: Are these people who are trained are they more likely to go to the research or extension part of RAB?

CIALCA_researcher3: Yeah, everybody who wants to do research but the resources are not available to keep everyone as a researcher. So that is a reason…I think the government needs to pledge(?) both. How do I feel…how do I put it…that those in research are more recognized than those who are doing extension. So mixing the two, we are all doing all the same, we are both in the same program, we are doing the same activities, to make the staff all equal. That was a good strategy.

Interviewer_EvS: Yeah, I was wondering if there is a program like….let's say there is a fertilizer program do they make an equal team or researchers and extensionists? Or is it sometimes just really only researchers or only extensionists.

CIALCA_researcher3: No, they both work together. They go for on farm trails. They but the researcher and the extensionists together. So from there they see the results that they have to disseminate and agree upon. (…)

Interviewer_EvS; Yes, because that is quite recent. Isn't it? I heard that RAB before was two organizations RADA and ISAR.

CIALCA_researcher3:: Yes, yes. You know what I am saying. If you make it two. Some people will feel more superior then the other. So if they are feeling more superior then the other it takes a lot of (…) to focus in the same institute. So bringing them together make them feel they are equal. They can share problem, they can share experience together and euh they will to promote technologies. Because they work in collaboration.

Interviewer_EvS: Do you see the difference between the time before the merge of RADA and ISAR into RAB and now? Is there a big difference in organization for CIALCA with how they approach innovation?

CIALCA_researcher3: is saves a lot of time and money. You are going to make two big institutions into one. This saves time and money. It takes the technology faster than when there are two. You know when there are two it has a lot of institutional bottlenecks. Develop technology, they take it

to other organization to validate but when both institution are in one the development and the validation will go smooth(?). It is more productive. It terms of time and resources. More economical.

Interviewer_EvS: I mean, I have never been able to see RAB so this is just a practical question. Are they in the same building?

CIALCA_researcher3: Yes yes, they are.

Interviewer_EvS: So they can easily meet and talk.

CIALCA_researcher3: Yeah, it makes things easier and it makes things look equal. When you are a researcher you feel that you are more superior then someone who is not a researcher.

Interviewer_EvS: I think I have one more question I have to scroll down for a moment. Oh, I have two, oh no I have one. Euhm, when ISAR and RADA changed into RAB did it change anything for CIALCA

CIALCA_researcher3: In 2012…

Interviewer_EvS. Sorry…oh in 2012. Did it change anything for the partnership that CIALCA had. Did they have to adjust or did the communication have to change or did the management have to change?

CIALCA_researcher3: Yeah, as one institution now it makes things easier it depends where the responsible for the different activities…making two arrangements one it makes some people feel redundancy. Because they were director in or extension where you made it to the other (…) because RAB doesn't have to (…) but in summary it made it more economically and productive.

Interviewer_EvS: And for CIALCA did this change have impact on them?

CIALCA_researcher3: Not quite much because our major partner was the research arm so the transition from ISAR to extension was internal, didn't concern us. We worked basically with the research institutes. The research institutes adopted our technology. We worked in collaboration we do field trails together. When we talk about our technology. The dissemination of technology is better now. Country specifically (…) we can only come to see our new varieties being used, being adopted by the ownership that was created by the national system.

Interviewer_EvS: So the partnership stayed the same for CIALCA.

CIALCA_researcher3: Yes.

Interviewer_EvS; They did no notice much.

CIALCA_researcher3: Not doing research.

Interviewer: That is nice.