Transformation for Smallholder Farmers: Pathways for Agricultural Development in Rwanda

Jolly Dusabe

Queens' College, University of Cambridge

Centre for Development Studies

University of Cambridge

This thesis is submitted for the degree of

Doctor of Philosophy

September 2019

Declaration

This thesis is the result of my own work. It is not the same as any that I have submitted, or, is being concurrently submitted for a degree or diploma or other qualification at the University of Cambridge or any other University.

The thesis does not exceed the prescribed word limit as specified by the Faculty of Human Social and Political Sciences.

Signed: J. Dusabe

Dated: 27 September 2019

Jolly Dusabe

Cambridge

Transformation for Smallholder Farmers: Pathways for Agricultural Development in Rwanda

Jolly Dusabe

This thesis asks: "What are the drivers of smallholder agricultural growth in Rwanda?" Since 2000, Rwanda has recorded unprecedented year on year growth in agricultural production, averaging more than 5% per annum. This growth, driven mainly from the food sector, has occurred after decades of stagnation. The government of Rwanda sees agricultural growth as a critical driver for poverty reduction and economic growth. The study examines policy measures adopted by the government of Rwanda in pursuit of this growth, evaluates the mechanisms for implementation, and asks farmers and other stakeholders which interventions were most significant.

Chapter 1 introduces the study and its objectives. Chapter 2 outlines Rwanda's history in the agricultural sector up to 2000, and describes the policies that were developed after 2000, and the launch of those policies into the field thereafter. It looks at government-led initiatives for land use consolidation, infrastructure and crop intensification, and also at the processes whereby the private sector is brought in to support growth. Chapter 3 reviews literature relevant to the role of the agricultural sector in development, and the processes by which change occurs. Chapter 4 outlines the mixed methods and methodological framing of the study.

The four data chapters (Chapters 5, 6, 7 and 8) paint a detailed picture of policy generation processes and demonstrate how different participants experienced it. In Chapter 5 a survey of farmers shows the direct changes that have occurred in farming and farming practices. Chapter 6, on technology adoption, uses survey data and interviews to draw directly on farmer experience and decision-making. Chapter 7 explores survey data and focus group discussions to show how institutional development at grassroots level played a part in the process of change. Chapter 8 draws on testimony from a range of policymakers, donors, other stakeholders, local leaders and farmers to understand new alliances, partnerships and arrangements that demonstrate benefits of collective action in the process of growth.

Chapter 9 draws conclusions from the study. It shows the extent to which policy institutions and has facilitated technology adoption in Rwanda since 2000, and highlights the new institutional arrangements that have emerged to drive the process of agricultural change for smallholder farmers.

Dedication

To my parents Julia and David Munyangabo thank you for your unwavering love and support

Acknowledgements

The past four years have been a truly enriching experience of deep learning and self-reflection. I am grateful and indebted to the many people who made this research journey possible and exciting.

Dr Shailaja Fennell, my supervisor, thank you for taking me on and for being genuinely interested in my work as well as the Rwandan farmer. Thank you for your excellent advice, feedback, stimulating discussion, patience and generosity with time. You believed in me and trusted in my ability to succeed.

I am grateful to the Rwandan government, Cambridge Trust, Queens' College, Smuts Memorial Fund and Department of Political and International Studies (Polis) whose financial support made this research possible.

My respect goes to farmers and others who gave me their time and shared their experience. My desire has been to make your stories known through this thesis.

I thank my peers, staff at the Centre for Development studies and especially to fellow Fennellians who have become great friends. Your contributions to this thesis through presentations and other discussions have been hugely appreciated. I must particularly mention Richard Sidebottom, Nafisa Waziri, Nungari Mwangi, Hima Halimatou, Taskeen Adam, Matthew Fright, Rekha Bhagaonkar and Shachi Amdekar.

I am privileged to have wonderful friends who have accompanied me in this PhD journey. Thank you especially to Cal and Mimi Wilson, Clare Shepherd, Jennica Stephens, Claire Wilkinson, the Maramba's, Dineo Lioma, Viola Muhumuza, Julianne Birungi, Leon Jonck, Helen Saunders, Miriam and John Ogborn and Mama Tessa and Papa. Thank you, Jane Lichtenstein, for your friendship, and for making my stay in Cambridge a memorable one. Agnes and Anaclet Kalibata I am grateful for your encouragement. Emma and Thierry Ngoga, you have been amazing, thank you for your unwavering love and support.

I am grateful to my wonderful family, without whom I could never have attempted this PhD. Thank you for sharing my struggles and successes. I am fortunate to have an incredible big sister, Jeanne Gasasira, who has kept an eye on me since childhood. .

My utmost gratitude goes to God, thank You for every word written in this thesis.

Contents

Abbreviations and Glossary

Abbreviations

CIP	Crop Intensification Program
EAGC	Eastern African Grain Council
EAX	East African Commodity Exchange
FA	Farmers' Associations
FC	Farming Cooperative
IDP	Integrated Development Project
JAF	Joint Action Forum
LWH	Land husbandry Water harvesting and Irrigation Project
MINAGRI	Ministry of Agriculture and Natural Resource
MINALOC	Ministry of Local government- Rwanda
MINIRENA	Ministry of Natural Resources
MINITERE	Environment, Forests, Water and Mines
NISR	National Institute of Statistics Rwanda
RCA	Rwanda Cooperative Agency
RGCC	Rwanda Grain and Cereal Cooperation
RSSP	Rural Sector Support Project
Sacco	Saving and Credit Cooperative
SG	Saving Group
VUP	Vision 2020 Umerenge Program
WUA	Water Users Associations

Glossary of Kinyarwanda words

Kinyaranda words	**English meaning**
Amasaka	Sorghum
Ibibina	Saving groups
Imihigo	Performance contracts
Imyungu	Gourd
Indulu	Hassle
Ingemeri	Measuring container
Intare	Lion
Inteko	Citizen assemblies
Isogi	Brassica plant
Isoko	Market
Muganda	Community work
Taro	Colocase (Scientific grass name)
Ubudehe	Mutual solidarity at grassroots
Ubukode	Traditional land use systems
Uburo	Millet
Umudugudu	Village
Umutekano	Feeling safe and secure
Urugwiro	Hospitality

List of Tables

List of Figures

Chapter 1: Introducing the Study

The central focus of this thesis is to understand the processes by which agricultural problems are diagnosed, policies designed and implemented, through the responses of smallholder farmers in rural Rwanda. The question of what it takes to develop smallholder agriculture is one that is extensively discussed in the literature and among policy makers. This thesis discusses why Rwanda prioritized agriculture, what policies were used to initiate growth and their impact on smallholder farmers. The research, which analyses agricultural development from 2000 to 2016, asks the question: '**What are the drivers of smallholder agricultural development in Rwanda?'**

From 2008 to 2015 I worked at the Ministry of Agricultural and Animal Resources (MINAGRI) in Rwanda. My role was to coordinate donor funded rural development programs whose aim was to support smallholder farmers to increase their productivity and incomes and reduce poverty. This required spending significant amounts of time in the field talking to farmers and local leaders to understand needs, identify key problems, priorities, and possible. My eight years of experience in managing these rural development programs provided me insights into the challenges of state-led coordination and these experiences form the basis of my analytical framing of this thesis.

Agricultural development is complicated not only because each planting season is unpredictable but by a host of social, political, cultural, economic, institutional, and environmental factors that affect rural smallholder farmers. It also takes considerable government effort and coordination to create an environment that supports rural and poor farmers to increase crop yield and engage in lucrative commercial farming. This thesis draws on an institutional economics perspective to address the question of how policies and institutions affect smallholder agriculture (Kirsten et. al. 2009). Successful agricultural policies have been the exception rather than the rule and the greater incidence of failures have been attributed to high transaction costs and poor information flows (Dorward, et. al. 2009). It builds on the accepted understanding in the field of institutional economics that African countries need to achieve sustainable intensification through their agricultural policies (Dorward, Kydd and Poulton, 2005). It recognizes the findings in institutional economics that weakness and failure in markets is due to inadequate coordination, and that in the presence of information asymmetries and high transaction costs that agricultural strategy must be part of a state-led development policy (Kirsten, et. al. 2009).

The thesis addresses the question of how Rwandan state-led development policy addressed the challenge of coordination failure through directly intervening in the nature of inter-personal interactions (through the creation of cooperatives) and by reducing transaction costs by providing the required infrastructure, conducting training to disseminate information and increasing knowledge base of the farmers.

The thesis draws on the notion of 'complementary coordination' that sets out problem associated with arranging a series of interdependent actions that have to be undertaken by different units, and where these individual actions need to be linked together to ensure the success of a policy initiative (Poulton and Lyon, 2009: 171) to understand the effectiveness of the Rwandan agricultural policy framework in addressing the problem of 'complementary coordination' through directing smallholders towards developing cooperative forms to manage these linkages. It is clear that the outcome ultimately depended on farmers and certain questions arose in relation to managing each action and ensuring that it takes place in a manner conducive to achieve these linkages, for example:

Will farmers manage and use the infrastructure well to maintain production? Will there be inputs for farmers who need them? Will farmers have sufficient rain at the right time? When farmers succeeded and a bumper crop was expected, the question became, will they have access to the right markets?

Agricultural transformation is indeed a complex process motivated by several interconnected factors that incentivize change at many levels. The analysis of these processes is the central focus of this thesis.

This introduction provides the context to the study and is structured as follows:

Section 1.1 outlines Rwanda's successful agricultural performance and how this has not met with universal acclaim. In part this reflects an ongoing global debate on policy design and the role of smallholder farmers highlighted in section 1.2.

This debate on smallholder agriculture development[1] provides the platform for my research question in Section 1.3, which reframes an evaluation of the issues from a farmer's perspective. Section 1.4 presents the Positionality and Reflexivity of the Researcher and 1.5 outlines the structure of the thesis.

1.1 Agricultural development in the Rwandan context

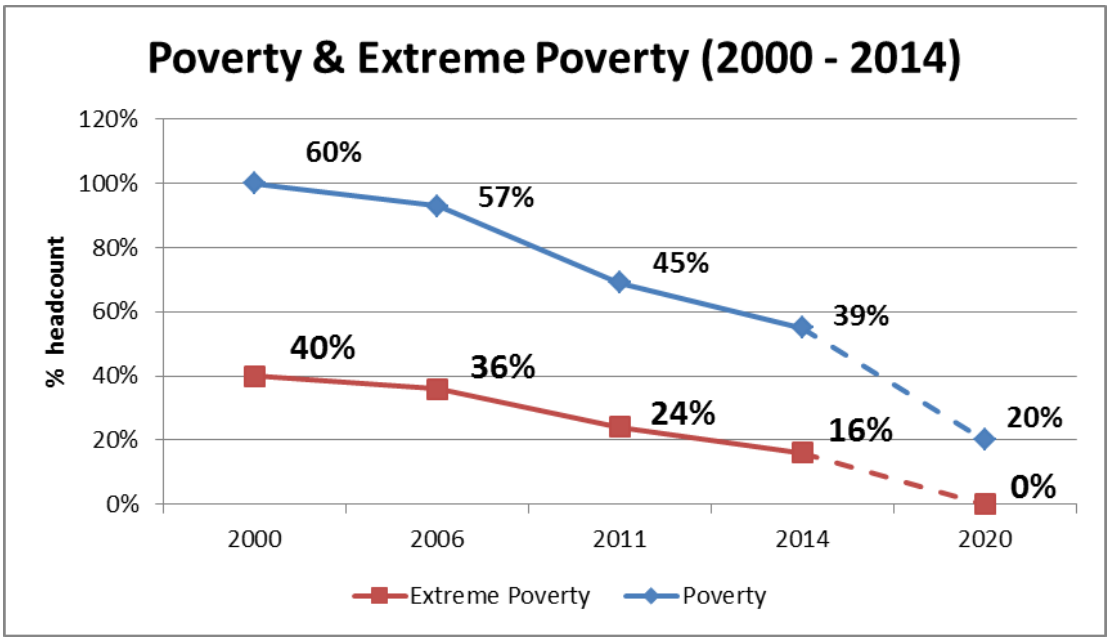
Rwanda is a small, hilly, land-locked country, with a population of about 12 million people. It has a population density of about 440 people per Km^2 and population growth of 2.4% per annum (National Institute of Statistics of Rwanda 2018b). Despite the relative scarcity of land and the genocide against the Tutsi in 1994 that destroyed the economic and social structure of the country, Rwanda is amongst the top countries in the region in terms of agriculture development. It has risen to become one of the most progressive countries in Africa (World Bank 2013).

Following widespread policy reforms, Rwanda has made significant strides towards economic growth and poverty reduction (Figure 1.1) in just 15 years. Since 2000, Rwanda's economy has grown by 8 per cent per year on average and GDP per capita has increased from $242 in 2000 to $729 in 2015 (National Institute of Statistics of Rwanda 2016).

---

[1] A more extensive discussion of these issues can be found in my literature review in Chapter 3.

Figure 1.1: Poverty and extreme poverty in Rwanda (2000-2014)



Source: (National Institute of Statistics of Rwanda 2014)

This growth facilitated (and was facilitated by) a halving of the proportion of the population in extreme poverty (Figure 1), the reduction of under-five mortality rates by 97% (USAID 2009), a 75% fall in the incidence of malaria and AIDS-related diseases (World Health Organization 2014) and an increase of primary education enrollment rates to 90% (United Nations 2015). With improved living conditions, life expectancy at birth increased from 48.2 years in 2000 to 66.7 years in 2015 (National Institute of Statistics of Rwanda 2018a).

Agriculture has been a key contributor to Rwanda's economic performance (World Bank 2014). From just 0.8% in the 1980s (GoR 2000a), the average annual agricultural GDP grew at 5.2% between 1999 and 2014 (Diao, Bahigwa, and Angga 2014).

The sector still employs 70% of the population and accounts for 33% of GDP (National Institute of Statistics of Rwanda 2018a) 2014). It is comprised of five sub-sectors: food crops; export crops (mainly coffee and tea); forestry; livestock; and fishing. The largest sub-sector, food crops, account for nearly two-thirds of agriculture's GDP contribution (58%) (MINAGRI 2018). However, production remains heavily reliant upon small-scale subsistence farmers. The average household landholding is only 0.5ha and most cultivation is rain-fed on hillsides prone to soil erosion (National Institute of Statistics of Rwanda 2014).

1.2 The global views on smallholder agriculture

Views on the relative importance of agriculture to economic growth underwent a rapid shift after the Green Revolution in Asia when the sector demonstrated potential to increase food security, agricultural incomes and facilitate industrial growth. Where agriculture employs a high proportion of the population and is a key contributor to GDP, it is increasingly seen as an important instrument for poverty reduction (Hazell 2005).

However, in some developing countries, specifically those in Africa, progress in agricultural transformation has been slow. For decades, domestic and international policy discriminated against agriculture (Bezemer and Headey 2008). Extractive policies that prioritized manufacturing, cash crops and promoted exports limited investment into smallholder agriculture (Delgado 1995).

Darkoh (1989) points to the neglect of smallholder farming during the colonial and post-independence periods as the reason why many African countries experienced food shortages. Exports were favoured for political and economic reasons (Bates 1981) but also because the sector requires limited government intervention (Lele and Agarwal 1989). Generally, governments tended towards supporting larger export-oriented farmers, because smallholder agricultural development requires specific state intervention to remove constraints to access to information, technology, credit and markets for the rural farmer. The World Bank's liberal policies in the 1980s that limited government intervention made it more difficult for farmers (Bryceson et al. 2010).

In contrast, some developing countries, particularly those in Asia, that prioritised agricultural development witnessed significant reduction in poverty and economic transformation (Fernando 2013).

Since the onset of the millennium, there has been a renewed focus on agriculture to increase food security and reduce poverty in African countries. African leaders, during the Maputo declaration in 2003, committed to take a central role in driving agricultural transformation through the Comprehensive African Development Program CAADP (NEPAD 2003). Despite this commitment, progress is still slow for many countries (CAADP 2017). There is still the question of whether, in the face of globalisation and climate change, small-scale agriculture can deliver the long awaited Green revolution in Africa (Collier and Dercon 2014). As an alternative model, Collier and Dercon advocate for more large-scale oriented agricultural development.

However, there is already an existing smallholder domain in which most farmers in Africa belong and which needs attention. Before smallholder agriculture is deemed powerless and unable to drive the agricultural transformation process, the more pertinent question may be: do we understand smallholder farming enough and has this sector been given the right focus and investment to explore its potential? In fact, countries are still figuring out how to address issues in smallholder agriculture efficiently.

As discussed in the 2018 African Green Revolution Forum (AGRF), it is often not the question of **what** needs to be done but **how** (AGRA 2018). It is this 'how' question that has motivated this research.

In my interaction with farmers, donors, private sector, service providers and experience of looking for solutions during my time at the Ministry of Agriculture in Rwanda between 2008 and 2015, I found that even when there is knowledge on what needs to be done, the difficult part is putting it in practice. Knowledge sharing is not straight forward because people often report progress, demonstrating achievements, but rarely do they explain the process of how they got there.

This thesis elaborates some of the key aspects that contributed to significant changes for smallholder farmers in Rwanda.

1.3 The research question

This in-depth study on smallholder farmers and the institutions that influence their lives, sits well in the global conversation on how to transform rural agriculture, increase productivity, food and reduce rural poverty.

My research, which asks the question, '**What are the drivers of smallholder agricultural development in Rwanda?'** aims to shed more light on the *process* of smallholder agricultural development and factors that have been important for growth.

Recognizing that agricultural change is a result of ongoing decisions and undertakings by farmers, this research seeks to assess the effectiveness of Rwanda's agricultural reforms from the farmer's perspective (Chambers 1963).

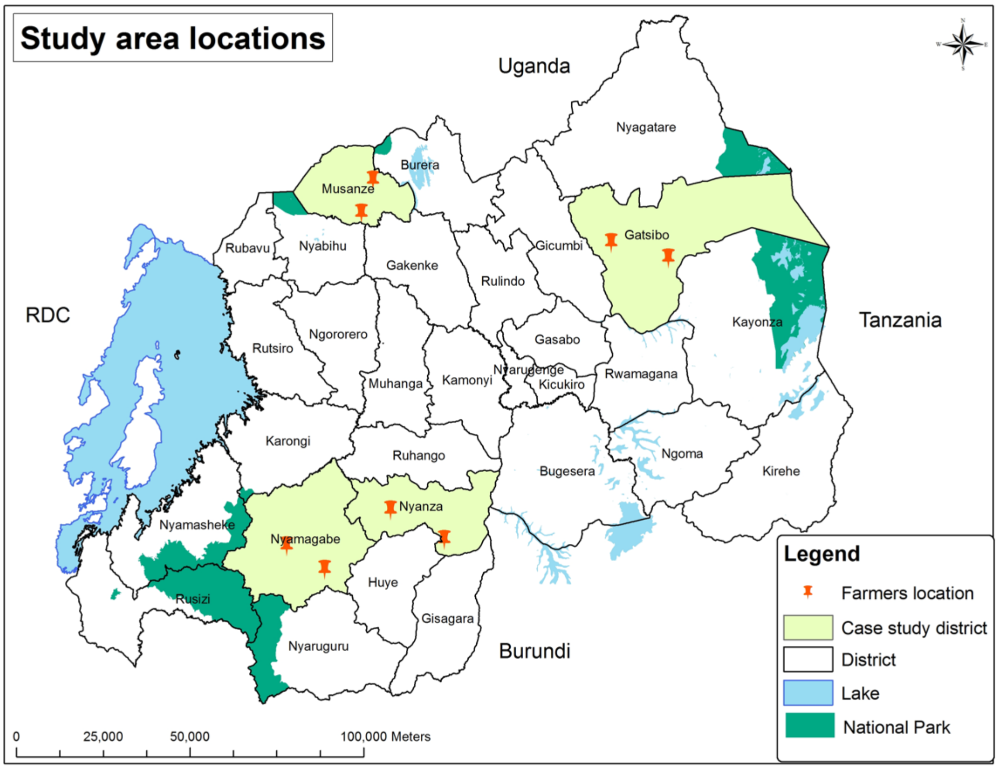
By listening to various voices of key players in the agricultural sector, the following 4 sub-questions are addressed:

1. Why did Rwanda prioritise smallholder agriculture?
2. What mechanisms were used to stimulate agricultural change?
3. What was the impact, particularly on rural farmers?
4. To what extent did agricultural reforms influence agricultural productivity and commercialisation?

To answer the research question comprehensively, I analysed narratives from policymakers, agronomists, donors and agrodealers and reviewed secondary data in policy documents, government reports, national data and studies.

Data is derived from a survey of 288 farmers spread across Rwanda and 30 interviews with policymakers, agronomists, donors and agrodealers interviewed in Kigali city and certain districts. Interviews with farmers and the survey were conducted from four districts: Gatsibo; Nyanza; Nyamagabe; and Musanze, as well as eight sectors (Figure 1.2).[2]

Figure 1.2: The location of farmers interviewed



Source: Author’s own

1.4 Positionality and Reflexivity of the Researcher

In line with the guidelines provided in qualitative research (see, for example Corlett and Mavin (2019)), during this research I put in place several moments to reflect on issues of objectivity, subjectivity and positionality.[3] Being a government official working in agriculture meant that I was subject to rigorous scrutiny from the government and farmers themselves. On some

[2] The selection of the districts and sectors is explained in Chapter 4, the methodology chapter.

[3] See chapter 4 section * evaluating the limitation of the research

occasions, I found myself before the Rwandan parliament or the courts of law, answering queries from farmers. In my day to day tasks, I was aware of the accountability and feedback mechanisms guiding public service. This prior knowledge and engagement with the existing accountability and feedback mechanisms in Rwanda were instrumental in informing my preface of reflexibility as a researcher. Compared to other researchers who looked at the same issues, this puts me in a unique and advantageous position. However, I am aware that precisely because of prior engagement, I have to be much more reflective about my position as a former government official. Corlett and Mavin (2019) note that social realities are constructed and not entirely objective since the researcher's particular interests and specific experiences shape the knowledge produced. I understand that my research interests and questions have been moulded and influenced by my own experiences and background as a government official working with rural farmers.

1.5 The thesis structure

The thesis engages with a broader debate on smallholder agriculture and its role in agricultural transformation. It analyses the current policies in Rwanda to assess the effect on farmers.

To begin with, Chapter 2 provides a broad overview of agricultural development in Rwanda. It uses policy documents, reports and studies to explore the process of agricultural development and mechanisms used to stimulate change. The chapter analyses the impact of policies on the general performance of the agricultural sector.

Chapter 3 gives a global perspective on agricultural development and reviews ways in which some advanced countries tackled the issue of rising productivity. The chapter reviews literature on agricultural development in general to understand key drivers of smallholder agricultural transformation.

Chapter 4 uses the propositions in the literature reviewed in Chapters 2 and 3 to develop the analytical framework for the study. This research uses grounded theory and applies a mixed method approach to collect data. Qualitative and quantitative data were collected through the farmers' survey and through interviews with different stakeholders. The different approaches used promote a holistic assessment of the research question and enhance complementarity between the different strands of data.

Chapter 5 sets out interviews from policymakers to examine the process of problem diagnosis and policy formulation to understand why agriculture was prioritized and the mechanisms used to facilitate change at the farm level. The chapter uses survey data to investigate changes farmers have experienced since 2000 and how these changes have affected their lives.

Chapters 6, 7 and 8 build from the foundation of Chapter 5 and use different strands of primary data and various voices to analyse changes in technology, and in institutional arrangements and organization at the national and grassroots level that have been important for farmers. These chapters underscore alteration in agricultural systems, and analyse why and how change occurred. In particular, these chapters analyse factors that affect technology adoption, land productivity and commercialization among smallholder food producers.

Chapter 9 draws out the conclusions of my research. Among the many alternatives, Rwanda opted for intensification of policies to facilitate increased land productivity and income and to reduce poverty. A significant proportion of farmers in the study have made adjustments to their farming systems over the study period to increase productivity. While the transition has not been without stress, farmers appreciate the strides they have made. I argue that agricultural change in Rwanda is driven by policy that is grounded on sustained agricultural prioritization, thorough problem diagnosis, and inclusive institutions that enable technological change at the farm level.

The next chapter on Rwanda discusses agricultural development before and after the recent government reforms. It analyses policy documents to explore the process of agricultural prioritisation; the different policy instruments used to generate increases in productivity and commercialisation among rural farmers; and the impact of these policies on smallholder agriculture.

Chapter 2: How Smallholder Farmers in Rwanda Succeeded at increasing food production

Since 2000, Rwanda has recorded unprecedented agricultural growth. Average annual agricultural GDP growth was 5.2% between 1999 and 2012, while the food sector grew at 6% from 2006 to 2012 (Diao, Bahigwa, and Angga 2014). Smallholder farming came into focus after agriculture was underlined as the core driver of economic improvement and poverty reduction in Vision 2020. Yet agricultural transformation in Rwanda is complicated by the fact that farmers work under tough conditions of small land sizes, difficult terrain and unpredictable weather. Average farm size per household has reduced from about 1 hectare per household in the 1980s (May 1995) to 0.59 ha in 2013 (National Institute of Statistics of Rwanda 2014). This chapter draws from policy documents, reports and other literature to understand what Rwanda did differently to stimulate growth in the agricultural sector.

While Rwandan agricultural data indicates that there have been significant achievements in the agricultural sector, there have been criticisms, from some quarters, of Rwanda's development process. While some see the changes in Rwanda, and in agriculture especially, as self-evidently good in terms of outcomes, there are others who question the means by which they were realised. Where Rwanda's agricultural development model and the positive impact on productivity and poverty reduction have been lauded in some international circles (World Bank 2016, IMF 2011, Nilsson 2018, Murindahabi, et al 2018), there are others in the international sphere who have critiqued the process of change. Dawson, Martin, and Sikor (2016), make the case that Rwandan agricultural policy has led the government to impose programs on farmers, rather than to support induced innovation. This echoes points made by Pritchard (2013), Ansoms (2009), and Huggins (2009, 2012 and 2017); all of whom claim that Rwanda's agricultural policies are insufficient and opposed by farmers. They say that the policies have reduced productivity and land tenure security to the detriment, particularly, of poor farmers. In summary, the five main arguments raised by these authors are:

1. That the Rwandan state has followed an 'authoritarian high modernist' path, and has not permitted any policy debate during the design and implementation of the agricultural policies (Huggins 2017; 2009)
2. The objective of shifting from subsistence and multi-cropping systems to crop specialisation (CIP focus on 6 prioritised crops) and commercialisation has reduced crop diversity, which may lead food insecurity (Huggins 2017; 2009; Dawson and Sikor 2016)
3. The government uses coercive measures during the implementation of the agricultural policies and there a risk of farmers losing land due to noncompliance (2017; 2012; 2009); Dawson and Sikor (2016); Pritchard (2013); and Ansoms (2009)
4. The Land registration and CIP policy have led to tenure insecurity (Huggins 2017; Pritchard 2013)
5. The impact of the agricultural and land policies has been detrimental to farmers causing food insecurity, landlessness and poverty (Dawson and Sikor 2016).

The underlying framing of these arguments arise from the conceptualisation of the Rwandan state as authoritarian and that consequently any progress made in Rwanda by policies it has undertaken are 'invalid'. Okito (2019) goes further to refute Rwanda's methods of assessing poverty levels, and that progress has not been achieved and that that poverty in Rwanda has risen sharply since 2000. These authors draw from concepts within the academic disciplines of political science, and anthropology while this thesis adopts a conceptual framework that sits in a disciplinary field that is laterally situated.

The field of development studies, particularly that which draws on tools of institutional economics, regards the state as having a primary role in charting the path of development, due to the very fragile market conditions that exist in developing economies. The heuristic notion of the 'developmental state' as an alternative to markets, that was evidenced in the development trajectory of East Asian economies, has become well-established since its early introduction in the 1980s (Evans, 1989). While the term 'developmental state' has come to be regarded in anthropological thinking as being akin to an 'authoritarian high modernist' form of the state, the term continues to be regarded as a valuable framing in development studies as it focuses on the imperative for state-led development policies in the face of poorly functioning markets.

The analysis of how state policies are directed by state and non-state institutions evolved into the fields of New Institutional Economics (NIE) and Institutional Political Economy (IPE) by the end of the 1990s (Harris, Hunter and Lewis, 1996). There are differences between these strands in the institutional literature, in how they regard the interactions between the state and societal forces and this thesis draws directly on Migdal's classic thinking on state-in-society and his depiction of struggles and accommodations between state and types of outcome: total transformation, state incorporation by social forces, incorporation of the state, and disengagement by the state (Migdal, 1994: 24). It recognises that the case of total transformation that takes place when the state uses processes of co-optation or subjugation of local social forces in the face of prolonged civil war or unrest, and which seems to tally with the development trajectory of China in the early decades of national development, might also be applicable to the case of Rwanda. This does not imply that the Rwandan state cannot be analysed through the lens of a developmental state. Indeed, the notion of the developmental state having been devised to conceptualise the East Asian development experiences makes it particularly suitable to analyse the Rwandan experience.

This thesis will examine the agricultural policies in Rwanda, to understand how the developmental state used its policy making to improve the market conditions in Rwanda. This is undertaken through an examination of multiple stakeholder voices including, in particular, many smallholder farmers from around the whole of Rwanda. By focusing on farmers' own experiences, and asking them how they view agriculture, and life before and after the recent reforms, the research aims to shed light on how state and societal interactions took place in the Rwandan countryside. The detailed conceptual model will be presented in Chapter 4, after undertaking an analysis of the historical development of smallholder agricultural systems.

The chapter is organised chronologically, to examine the historical context in which contemporary smallholder agricultural systems emerged and understand the reasons for the change. It sets the stage for chapters 5, 6, 7, and 8 that analyse; why smallholder agriculture was prioritised; farmers' responses to new policy; and the impact of the system on productivity and commercialisation.

In each period, the chapter analyses smallholder agriculture highlighting government policy and strategies and their impact on the sector as a whole. During the period of rapid growth (after 2000), the chapter records the changing global policy and the mixed responses from analysts to highlight the context in which Rwanda was operating.

Taking 2000 (the year in which major economic reforms started) as the pivotal year, the literature on smallholder agriculture in Rwanda is analysed in two periods, before and after 2000. In each period the chapter underlines key changes in smallholder agricultural systems. The period after 2000 is studied in detail since that is when smallholder agriculture in Rwanda came into focus.

This chapter lends itself to the 3-phased agricultural development model posited by Dorward, Morrison, and Urey (2004). The model highlights the role of the government during the three initial phases of agricultural development. It shows that in the first phase, the government aims to create an enabling environment for agricultural improvement. In this stage, productivity is limited. During the second phase, the main focus is to kick-start markets in order to generate demand for agricultural inputs, and stimulate increased productivity. Phase three involves government withdrawal from the market.

This phase is characterized by increases in the demand for input, productivity and private sector engagement into the agricultural sector.

This chapter draws from the Dorward, Marrison, and Urey (2004) approach to trace the different stages of agricultural development in Rwanda. To understand the change process, the chapter reviews the different instruments used to facilitate agricultural improvement at each stage during the study period between 2000 and 2016. The period under investigation is divided into 3 stages as shown in Table 2.1.

Table 2.1: Stages of agricultural development in Rwanda after 2000

Stages	
1: 2000-2005	Laying the foundation through government policy foundation
2: 2006-2010	Stimulating radical changes in productivity
3: 2011-2016	Changing to more market led systems

Source: Author's own

The chapter is divided into 4 sections that describe the instruments used to generate growth in agriculture and their impact on the sector as a whole: Section 2.1 gives a historical background of agricultural development before the reforms to highlight polices that influenced smallholder food production during that period and contextualise changes after 2000; Section 2.2 discusses Stage 1 of agricultural development (2000 -2005), and highlights the motivations behind smallholder agriculture prioritisation and the new policy framework developed to lay the foundation for growth; Section 2.3 examines the government-led programs and interventions in Stage 2 (2006-2010), initiated to catalyse productivity at farm level; and Section 2.4 describes market development and the expanding role of the private sector in Phase 3 (2011-2016).

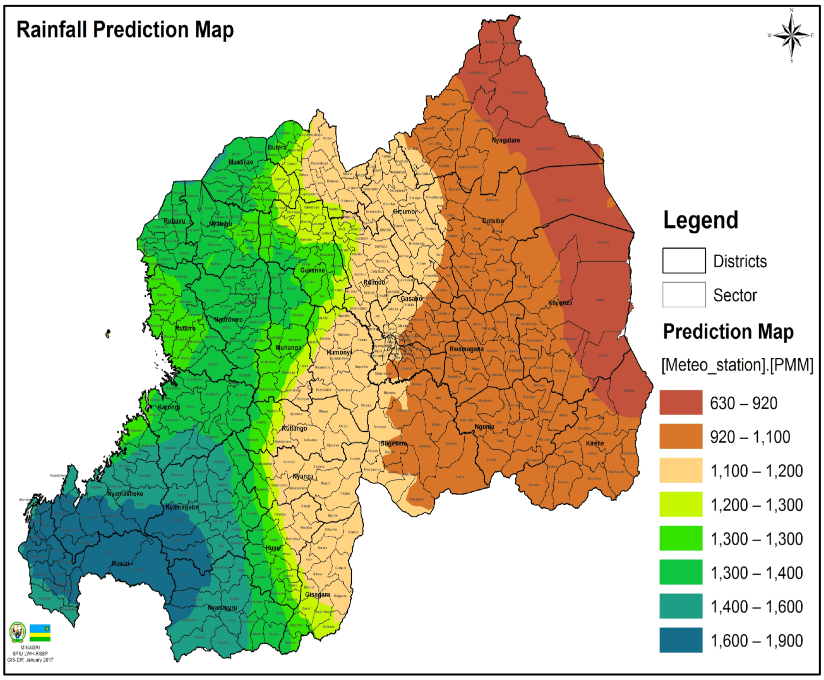
2.1 Agricultural systems in Rwanda before 2000

This section is an historical overview of agricultural systems in Rwanda. It explores the literature on smallholder farming systems in the 20th century, highlighting factors that influenced agricultural change during that period.

Over time smallholder-farming patterns progressed within the bounds of old cultures and political systems. Although choices of agricultural systems reflect political, economic, social and cultural processes, variation between regions occurred, naturally influenced by environmental factors like rainfall and topography (Olson 1994).

The topography of Rwanda permits a mild average temperature of about 19^{0}C, with bimodal rainfall patterns. Rain falls from March to May, and from October to December, with the dry months between June and August resulting in a slacker period for farmers. Figure 2.1 shows Rwanda's rainfall map. Historically, cultivation was on upper ridges of hillsides where soils were more fertile and cultivation was easier (Clay 1998).

Figure 2.1: Rainfall map of Rwanda



In the early 20th century, agricultural systems were polarised between ethnic groups. The Hutu were predominantly land cultivators while the Tutsi were mainly pastoralists (Segal 1964). The two ethnic groups coexisted in a shared culture that allowed mobility from one ethnic group to another (Lemarchand 1966). Tutsi pastoralists, who were also the rulers, monopolized control over cattle and land. The principal form of land tenure was a contractual system between the Tutsi patrons and Hutu clients known as 'Ubukonde', which means cleared land (Linden 1975). In this system, patrons provided clients with land, protection and a specific number of cattle in exchange for food, labour, and pasture. While pastoralists tended to remain in the valleys, agriculturists were confined to the hillsides where they cultivated land for food.

Native food crops included Amasaka (sorghum), Uburo (millet), Imyungu (gourds), Taro (Colocase) and Isogi (Brassicaeae) (Leurquin 1963). With time, new crops including sweet potatoes, beans, peas, bananas, and maize were introduced by traders and explorers, increasing food diversity in Rwanda. However, since the territory was prone to frequent famines, the Belgian colonialists who took control of Rwanda's administration in 1918 after the First World War introduced new crops to address food insecurity. For instance, cultivation of cassava was made mandatory as a famine control measure (Leurquin 1963). In addition, valley cropping was begun, with farmers mostly growing sweet potatoes in the marshlands (Loevinsohn and Nkusi 1993). Traditionally, crop cultivation was grown around 'urugo' (homestead), where each year farmers rotated crops and after a certain period left land for long fallows. During the fallow period, land was available for cattle grazing, which maintained soil fertility. These traditional food production systems were eventually disrupted by colonial agricultural policies.

In the 1920s Belgian colonialists introduced intensive agricultural systems, capitalism and cash crop growing, facilitated by Catholic missionaries (Linden 1975). Mission grounds were used as experimental stations and seed distribution centres for cash crops like tobacco and coffee. Coffee became an important export crop, supplied to European industries, and as a result farmers were ordered to apportion part of their land to coffee cultivation (Leurquin 1963). As Hutu cultivators gained access to the export income, education, and religion provided by colonialists, they became more independent of their Tutsi patrons but reliant on the colonialists (Segal 1964). The same colonial power that gave rise to the Hutu elite branded the Tutsi as superior (Mamdani 2001).

These contradictory colonial tendencies exacerbated social tension between the Hutu and Tutsi. The ruling Tutsi, who received preferential treatment from the colonialists, were made to feel superior to the Hutu (Linden 1975). Even the poorest of the Tutsi, who would previously have been seen as peasants, felt they were part of the privileged group from which the Hutu were excluded. In addition, the colonialists introduced identity cards that showed one's ethnicity, limiting the social mobility that existed between the two groups (Newbury 1978). The confinement to a specific group and formal accreditation of ethnicity increased the polarization between the Hutu and Tutsi. The inherent inequalities within the two groups gave rise to land disputes that became a major factor of the later conflict (Mamdani 2001). Eventually, the disgruntled Hutu majority (about 84% of the population), whose elite group was empowered by the money economy, education and the association with Catholic Church, overpowered the Tutsi ruling class.

In 1959, the Hutu overthrew the Tutsi in a violent revolution that forced many Tutsi to flee to neighbouring countries. Subsequently, in 1962, Rwanda gained independence. While the 1959 revolution led to a shift of power from Tutsi to Hutu, the country's independence did not remove colonial realities (Mamdani 2001). Instead, the colonial legacy was reproduced in the new institutions post-independence. The Hutu-dominated government concentrated power in the hands of a few elite groups, with ethnic appeal still resonating strongly in the country (Newbury 1978). These political events led to changes that significantly influenced agriculture.

The principal consequence of the revolution was that it ended the Tutsi dominated pastoralism, giving rise to a more agriculture- and Hutu-oriented system. As a result, land originally reserved for pasture was redistributed for cultivation (Olson 1995). The new land use reforms and agricultural extensification policy led to increases in cropland and food production. In fact, Rwanda was one of the African countries where food production grew faster than the population in the 1970s (Harrison 1987). This performance was mostly driven by land expansion, since farmers rarely applied modern technologies like high yielding seed varieties and chemical fertilizers to increase food output.

Interestingly, cash crop growers had access to inputs like chemical fertilizers, which were non-existent among food producers (World Bank 1991). Food production occupying 94% of arable land was constrained by farmers' inability to access technologies required to increase yields. This imbalance between the two agricultural sectors shows a clear trade-off between improving food for domestic consumption and improving cash crop production for export (Verwimp 2004). The strong focus on exports had its roots in the colonial era. Similarly, there was particular emphasis on fighting soil erosion.

Fighting erosion was a discourse that started during the colonial period (Leurquin 1963). After independence, the Government reinforced the colonial anti-erosion policies with similar enforcement approaches (Olson 1995). Farmers were mobilized in large numbers to engage in soil erosion control activities, mainly through community work ('Umuganda'). During community work, people were engaged in tree planting, cleaning drains, and the construction of erosion ditches and terraces. While there was noticeable emphasis on soil erosion control, very little was done regarding improvement of soil fertility.

2.1.1 The regression of smallholder agriculture

Land degradation and soil infertility, caused mainly by the increasing population, led to frequent localized famines, making life difficult for people (Randall 1970). Migration (some temporary) was rampant with up to 20,000 people relocating to neighbouring countries each year in a search for work and fertile land. Soil management and quality therefore became critical for food production and improving the quality of life, particularly because the population was increasing rapidly. Rwanda's population was growing at an annual rate of more than 3% each year.[4]

Population pressure stretched the already hard-pressed agriculture sector, as land for pasture, grassland, forest, and farrow significantly reduced (May 1995). Farmers with small plots engaged in more intensive cropping systems and were unlikely to leave land fallow (Byiringiro and Reardon 1996). A survey conducted from the 1980s until 1994 found that only 17% of the land in Rwanda was fallowed, and common land for pasture had disappeared (Clay et al. 1995). About 56% of cultivated land in Rwanda at that time was intercropped.

Farmers preferred mixed cropping, in order to meet household food requirements (May 1995). At the start of the rains, farmers planted cereals (mostly maize and sorghum); a few weeks later they added legumes (beans), then the longer maturing root crops (sweet potatoes and cassava). It was common to find a plot of land with several crops all growing in the same period. Cropping patterns were diverse and varied across agricultural regions (Olson 1994). Generally, beans, sorghum, banana, sweet potatoes, maize, and cassava were widely grown. Planting material was reserved after each harvest, with very limited use of hybrid seeds from research. Except for Irish potatoes, improved seeds were unavailable (Von Braun, De Haen, and Blanken 1991).

---

[4] World Bank (2019) World Population Prospects
https://data.worldbank.org/country/rwanda

The limited use of improved inputs in the face of reducing land size due to population pressure, constrained the extent to which farmers could increase food production, and weakened the agricultural sector. In fact, the 1989 famine in the Southern province was blamed on nonresponsive government policies and the weak agricultural sector (Verwimp 2002).

As president Habyarimana repeatedly underscored and as was recorded in government documents, agriculture and food sufficiency were often highlighted as a national priority (Verwimp 2002). However, his government consistently failed to put in place effective apparatus to mitigate recurring problems such as famine and hunger as was seen in the 1980s. Some analysts have argued that Habyarimana's government had become an authoritarian regime whereby state actors held tight control over land (Boudreaux 2009). The imposed restrictions on land sales, which led to elite capture, left smallholder farmers with small pieces of land. This constrained land purchases for efficient rural farmers able to engage in commercial agriculture. According to Verwimp "policies that Habyarimana executed during his reign, served his two main objectives: Rwanda would remain a poor rural society based on agriculture, and he would stay in power" (Verwimp 2000, p. 356). Rwanda's situation was worsened by frequent food shortage caused by unreliable weather and drought, social turbulence and political unrest.

2.1.2 Rebuilding after the genocide

During the 1980s and1990s the economy of Rwanda was weakened by the decline in food production and low coffee and tea prices.[5] In that period population growth was at an annual rate 3% higher than the 2.2% growth in agricultural growth . Meanwhile, there was mounting political unrest due to the unresolved issue of Tutsi refuge in the neighbouring countries. Decades of conflict between the two ethnic groups ended in a devastating genocide against the Tutsi in 1994 bringing the nation to a standstill.

---

[5] Coffee prices reduced by 30% from 1989 to 1991 (Verwimp 2002).

The catastrophic 1994 genocide against the Tutsi that decimated over one million people and left thousands widowed and orphaned was the height of the conflict between the Hutu and Tutsi (Kinzer 2008). The genocide, organised by Hutu leadership, marked the collapse of the Hutu regime, which had gained power after the 1959 revolution. Tutsi refugees that had lived in neighbouring countries for decades due to recurrent ethnic conflict after 1959 formed the Rwanda Patriotic Front (RPF) that defeated the Hutu and ended the genocide in 1994. In the aftermath of the genocide, the country was in a complex social and economic crisis.

The new government, whose focus was reconciliation, unity and economic development, had to deal with the devastating effects of the genocide in order to restore the country and make Rwanda a homeland for all Rwandans (Crisafulli and Redmond 2012). One of the challenges was resettling the influx of Rwandan refugees returning from neighbouring countries. More than 700,000 people returned in the first round, mainly consisting of refugees who had fled the country during the 1959 violence (Bruce 2007). Returnees had the right to claim previous property or be allocated other land elsewhere. Given that land was an important feature of the ethnic tension, it becomes a major issue in the reconstruction process.

The land crisis after 1994 was handled using innovative ways to manage and settle returning refugees. Provisional measures included giving people land that was abandoned but managed under specific regulations (GoR 2004b). Other people were given state-owned land, including forests, marshlands and national parks. For example, part of the Akagera National Park in the Eastern province was parcelled out and given to returnees. In some cases, to facilitate agriculture and food production, family land was redistributed to community members that had returned.

Agricultural activities resumed, supported by humanitarian agencies that provided food and seed (discussed below in Section 2.2). Despite the upheavals, and increasing land pressure after the genocide, by 2000 farming households were consuming more of their own food, and income had risen to the level of the early 1990s (Mckay and Loveridge 2005). However, due to a host of complex issues some of which have been discussed in this section, growth in agriculture was hindered (WDR 1990), resulting in Rwanda being one of the poorest countries in the world by 1999.[6]

This section shows that agricultural systems in Rwanda evolved over time, influenced by different institutions, policies and radical population increases. Power relations between the Tutsi pastoralists, Hutu agriculturalists and colonialist powers determined whether land was used for livestock or cultivation. While food production increased due the introduction of new crops and extensification policies that allowed more land exploitation, by the 1980s, rapid population growth had restricted the extent to which cropland could expand. Since both colonial and postcolonial policies mainly focused on export crops, smallholder food producers lacked productive technologies to increase land productivity. The already weak agricultural sector was dismantled by the 1994 genocide leaving the country in extreme conditions of poverty. The next section examines the period after 2000 to highlight some of the efforts made to foster growth in the agricultural sector.

2.2 Stage 1: Laying the foundation for growth (2000-2005)

At the onset of the millennium, Rwanda was ready to embark on economic development. The government's immediate focus after the 1994 genocide was national rehabilitation, reconstruction, security, and reconciliation. Policy makers believed that to emerge from a situation of extreme poverty, ethnic division, and conflict, the government, had to prioritise economic and social development (GoR 2000b). Consequently, an array of policies to stimulate the economy was introduced. Since the majority of the population were farmers,

---

[6] UNDP: Human Development Report 1999 for Rwanda.

agriculture became an essential sector for poverty reduction and rural development.[7] This section looks at the initial stages of smallholder agricultural development. It presents the initial policies launched to stimulate agricultural growth and their impact on their agricultural sector as a whole.

The first group of policies discussed in this section are set out in Table 2.2. They include high-level national policies like Vision 2020[8] and those specific to agriculture. As stipulated in Vision 2020, the main aspiration for Rwanda is to transform from a low-income, agricultural-based country to a knowledge-based, service-oriented economy with middle-income country status.[9] This was to be done in a political system that promoted reconciliation, unity, social cohesion, and equality.

---

[7] Chapter 5 analyses the process of agricultural prioritisation

[8] The process of developing vision 2020 is explained in Chapter 5

[9] According to the World Bank, Middle Income Countries (MICs), are those having a per capita gross national income of US$1,026 to $12,475 (2018).

Table 2.2 Policies related to agriculture between 2000-2005

Year	Policy /Main objective
2000	**Vision 2020** Transform the economy into a middle-income country **Interim Poverty Reduction Strategic Paper** An approach to the Poverty Reduction Action Plan for Rwanda
2001	**National Decentralization Policy** Enable the local population to participate in their development **Rural Sector Support Project (RSSP)** Improve production and reduce poverty
2002	**Poverty Reduction Strategic Paper (PRSP)** Provide framework for reducing poverty
2004	**National Agricultural Policy (NAP)** Create and enabling environment for increasing food and income for farmers **Strategic Plan for Agricultural Transformation (PSTA)** Provide framework for agricultural transformation **National Land Policy** Increased investment and land tenure security
2005	**Organic Law Determining the Use and Management of Land** Improve land tenure security and investment by formalizing customary land rights

Source: MINAGRI

Rwanda Vision 2020 was the overarching policy from which other policies emerged. It was stipulated that to achieve the Vision 2020 goal of becoming a middle-income country, year on year average GDP growth rate had to grow by at least 7% and the proportion of people in poverty reduce from 60% to 30% by 2020.[10] Since agriculture was underlined as a core pillar for economic development and poverty eradication, the government target was to maintain an annual growth of the sector at a rate of more than 5% (GoR 2000b).

An Interim Poverty Reduction Strategic Paper (PRSP) produced in 2000 highlighted some of the areas in which agriculture could be improved to benefit the rural poor, the vast majority of whom are farmers (GoR 2000a). The PRSP suggested improving land productivity, land tenure security and

[10] GoR (2000a) 64% of the population in Rwanda was in poverty in 2000.

marshland irrigation to increase agriculture output and reduce poverty. To understand key issues at the grassroots and engage local communities into problem diagnosis and policy formulation, the government promoted decentralisation.

Historically, Rwanda's political and administrative structures were largely centralized.[11] The 2001 decentralization policy aimed to encourage participation in policy decision-making and implementation at the grassroots level. Subsequently, government policy was to be implemented through the Ministry of Local Government (MINALOC) structure. Subsequently, powers and functions were devolved from central to local government at the province, district, sector, cell and village level (MINALOC 2001). Alongside the devolution of powers and functions, resources were also distributed to devolved levels using transparent criteria.

Traditional practices and cultural values of working together were utilized as institutions that could enhance community participation. As a result, home grown solutions including traditional local councils, citizen assemblies (inteko), community work (Umuganda), Ubudehe (mutual solidarity at grassroots), and performance contracts (Imihigo) became important conduits for communication and community participation in policy development and implementation.

Stakeholder engagement at the district level is enabled by a Joint Action Development Forum (JADF), which was instituted to enhance dialogue and interaction between local communities, local and international donors, and the private and public sectors (RGB 2018). Through these forums, government and local communities are able to know who is doing what, in

[11] Power was accumulated among a small number of people, both at the central and local level; for example, at district level, the powers were centralized in one person, the Bourgmestre (equivalent to a district Mayor).

order create synergies and the accountability needed for good performance. Communication is mainly through meetings.

Having outlined the development agenda (Vision 2020) and the PRSP, and having put in place mechanisms for policy formulation and implementation, Rwanda was in a suitable position to attract international funding. PRSPs were particularly important for funding institutions like the World Bank, which required countries to link sector policies to poverty eradication (World Bank 2004). Based on that, in 2001, the government negotiated a World Bank funded USD$160 million 17-year Rural Sector Support Program (RSSP) which became one of the biggest projects in agriculture with the mandate to support farmers to increase agricultural productivity, rural income, and reduce poverty.[12]

A number of other policies specific to agriculture were launched during this period. In 2004, the Ministry of Agriculture and Animal Resources (MINAGRI) launched 3 fundamental policies: the National Agricultural Policy (NAP) that gave the orientation and terms for agricultural development and the Strategic Plan for Agricultural Transformation (PSTA 1), which is the operational framework that outlines strategies, programs and action plans and budgets; the Ministry of Lands, Environment, Forests, Water and Mines (MINITERE) also spearheaded the National Land Policy, the aim of which was to motivate investment and increase land tenure security. By the end of 2005, the country had tools to address key issues in agriculture, including farmers' limited access to information, knowledge, land, technology, irrigation and markets.

In the same period (2000-2005) Rwanda was part of global initiatives important for agricultural development. For instance, in 2000 world leaders committed to redirecting resources towards poverty alleviation through the Millennium Development Goals (MDGs). In countries like Rwanda where the

---

[12] RSSP is known for its investment in capacity building programs for farmers and marshlands irrigation.

majority of the poor are farmers, agriculture-led growth would be critical for meeting some of the MDGs, particularly that of reducing poverty and hunger. Subsequently, African leaders, during the Maputo declaration in 2003, committed to finding solutions to poverty and hunger (NEPAD 2003). Through the Comprehensive Africa Agriculture Development Program (CAADP) countries are encouraged to use their resources, networks and abilities to generate growth in agriculture and stimulate economic growth. Similarly, the 2005 Paris Declaration on Aid Effectiveness promoted country-led development systems. Countries and donors agreed to enhance the quality and effectiveness of aid, promoting country ownership of their development processes. These shared goals stirred countries to rise to the challenge of agricultural transformation, poverty reduction and economic growth, a process, which Rwanda was already undergoing. This alignment of country and global goals positioned Rwanda for good performance and international support.

Looking at the impact of policies development in stage 1 (2000 and 2005), the country recorded average annual GDP growth rates of 6.4%, close to the Vision 2020 7% target (UNDP 2008). Likewise, average annual growth rates for agricultural were 4.6%, just shy of the 5% target (GoR 2008). The proportion of the population in poverty reduced from 64% in 2000 to 56.9% in 2005 (National Institute of Statistics of Rwanda 2006). Despite what was a decent economic performance during this period, there was recognition that more effort was needed to reach the desired results.

Generally, farmers were cautious about investing in agricultural inputs and increasing yields in conditions where lucrative food markets were scarce. This is because most farmers lacked the market information and bargaining power necessary to enable meaningful agricultural commercialization at the time. Given these reasons, farmers were not incentivized to invest in increasing output (Evans et al. 2006).

The period between 2000 and 2005 was accompanied by an array of policies aimed to set the scene for economic transformation and poverty reduction. Given that the majority of the population was in poverty and most of them were farmers, an agriculture-led economic development strategy, was pursued. The first generation policies specific to agriculture included a comprehensive agricultural policy, Strategic Plan for Agricultural Transformation, Land Policy, Rural sector support program and the decentralisation program. Although the government reforms led to a decent average annual agricultural growth rate of 4.6%, they had limited traction in meeting the desired target, mostly because they had not yet been fully operationalized. Having put in place an extensive policy apparatus, the next section explores the effort to generate more growth in Agriculture.

2.3 Stage 2: Stimulating radical increases in productivity (2006-2010)

The period between 2006 and 2010 can be seen as the second stage, in which more concrete actions towards galvanizing increased productivity and agricultural output were employed, to reach the targets set in stage one. Policies and program initiated in this period and discussed in this section are presented in Table 2.3.

Table 2.3 Policies related to agriculture between 2006-2010

Year	Policy /Main objective
2006	**Policy on cooperatives** Facilitate economic development
2007	**Signed up to CAADP** Agricultural transformation and poverty reduction
	Crop Intensification Program (CIP) Increase agricultural productivity and reduce food insecurity
	Land use Consolidation: Synchronize land use and management to increase efficiency in agriculture and access to services
	One Cow per Poor Household Diversify sources of income, improve nutrition and soil fertility
2008	**Economic Development and Poverty Reduction Strategy** (previously discussed)
	Restructuring of the Rural Sector Support Project (previously discussed)
2009	**Umerenge SACCO** Boost financial inclusion for rural Rwanda
	Roll out the land registration program Increase land tenure security
2010	**Development of the land husbandry water harvesting and Hillside irrigation program** Increased land productivity and reduce poverty

Having prepared an appropriate policy framework for agricultural transformation in stage 1, the country was in position to roll out a number of programs in stage 2. The policies and programs developed in stage 2 aimed to inspire action in key important areas. Firstly, it was crucial that the government mobilise resources to facilitate the agricultural development agenda. The CAADP process provided an opportunity to do this.

In 2007, Rwanda became the first country in Africa to sign the CAADP Compact.[13] This was to honour the commitment made by African leaders to

[13] The final outcome of a national CAADP process is a document called the Compact (which includes policies and agricultural investment plans), signed during the

increase the agriculture budget to at least 10% of public expenditures, and to grow the sector at an annual rate of 6% (Kimenyi, Routman, and Westbury 2012). It was understood that the ambitious target would be achieved through joint efforts driven by partnerships between government and other stakeholders. This process provided an important platform for MINAGRI to raise resources from different actors for the agricultural sector.

In a bid to coordinate investment from donors and ensure efficient policy delivery, MINAGRI signed a Sector Wide Approach (SWAP) Memorandum of Understanding with key partners in 2008 (MINAGRI 2008). Subsequently, both parties formed the Sector Working Groups (SWG), a forum that allows policy dialogue, accountability, development of new programs, and assessment of the on-going policies.[14] Some of the key policies in this period including the cooperative policy, Crop Intensification Policy (CIP), One Cow per Poor Household policy and the land policy targeted poor smallholder farmers. These policies are discussed in detail to understand their execution and impact on rural farmers.

In 2006, a new cooperative policy was launched. Although cooperatives have existed in Rwanda since the 1940s, used as tools for colonial and national governments to implement policy, the lack of a strong legislative and policy framework limited their potential (GoR 2006b). The policy aims to facilitate the formation of viable cooperatives that support social integration and facilitate community participation in policy discussion and implementation. This policy came at a time when development models that include cooperatives were globally upheld (ILO 2002). In agriculture, cooperative organizations are known to reduce the cost of production by pooling resources together, to increase visibility of farmers, improve access to information,

roundtable by all groups of stakeholders (including the ministry of finance) and donors in agricultural policy and which commits them to implement the Compact.

[14] See more discussion on the interaction between the donors and the government in chapter 8 Section 3

improve the ability to negotiate and improve access to markets (Harris, Stefanson, and Fulton 2005).

In a country like Rwanda where farmers are severely constrained by land, cooperatives were regarded as good instruments for promoting collective action and agricultural change (AFI 2014; GoR 2006). Following crop based cooperatives, the notion of establishing Saving And Credit Cooperatives (SACCO) in all 416 sectors in Rwanda, was passed by the cabinet to improve financial inclusion among rural communities.

As a result of the SACCO policy, 90% of Rwandans were within a 5km radius of a SACCO (AFI 2014). By 2014 about 22% of the population above the age of 18 had become members, and over 33% of accounts in the entire banking sector were from SACCOs. FinScope studies show that access to formal financial services for the Rwandan population had more than tripled by 2016, increasing from 22% in 2008 to 42% in 2012, and to 68% in 2016 (FinScope 2012, 2016). The assumption was that with more membership of cooperatives and an increase of financial services in rural areas, farmers' ability to access input credit would increase intensification and productivity.

2.3.1 Changing agricultural from extensification to intensification policies

As already discussed in Section 2.1, population increases, combined with over-cultivation on hillsides prone to soil erosion, left households with small and depleted land (Clay et al. 1995). Average land size per household fell from 2ha in the 1960s to 0.7ha in the 1990s (Bruce 2007). Today, average land size per household is a half-hectare.[15] Inevitably, crop intensification became an integral part of Rwanda's agricultural development plan.

---

[15] Land scarcity is discussed in Chapter 7, Section 1.

The objective of the Crop Intensification Program (CIP) was to stimulate increased food productivity through the use of agricultural technologies. 'Agricultural technologies' here refers to the use of improved seeds, chemical fertilizers and new farming techniques. CIP has 4 main components: facilitate farmers' access to high yielding seeds and chemical fertilizers; extension services; postharvest infrastructure and encourage land use consolidation. Dedicating a large proportion of its annual budget to CIP (80% of MINAGRI annual budget 2008 went to CIP) was a reflection of how significant this program was within MINAGRI (MINAGRI 2008). The implementation process and impact of each CIP component is discussed at length is this section.

Improving education and advisory services to rural farmers

A poverty evaluation in 2006 recommended that, to attain the required changes in agriculture, more farmers' had to be able to access advisory services (Evans et al. 2006). In order to efficiently provide access to advisory services to more farmers, the government reorganized the extension service system.

Prior to 2000, agricultural extension services provided solely by MINAGRI were delivered mainly through top-down approaches (GoR 2004c). After decentralization, MINAGRI and the Ministry of Local Government (MINALOC) simultaneously provided agricultural extension services to farmers (GoR 2006c). According to the decentralization policy, the mayor oversees agricultural planning and development at the district level. In order to support district teams, district agronomists were removed from the MINAGRI structure to MINALOC. Agronomists are therefore hired by the district and assimilated into the local government structure; one graduate is deployed at district and another, a diploma holder, at the sector level (Feed the Children 2011). At each level, an agronomist is responsible for overseeing agricultural activities for thousands of farmers. For example, at the sector level, one agronomist oversees activities for about 26,000 farmers, a ratio too high for effective service delivery. For this reason, district agronomists are supplemented by extension services provided by cooperatives, donor projects, and MINAGRI. These new arrangements have led to more interaction of local leaders with farmers on matters concerning agriculture.

In 2009, MINAGRI completed the National Extension Strategy, which recommended that pluralistic extension services approaches be used to reach more farmers, and to reduce the high extension agent to farmer ratio, which was 1:3000 at that time (MINAGRI 2009). One approach that has become popular over the years is farmer-volunteer service provision. This system often referred to as farmer-based extension service is built on a network of lead farmers who conduct and facilitate peer-to-peer learning mostly through demonstration plots. Given its effectiveness, the farmer-based extension system was scaled up and incorporated into a national extension system (GoR 2016). During the initial stages of CIP, MINAGRI recruited service providers, to supplement advisory services provided by farmers and the district agronomists (MINAGRI 2009a). This approach had positive effects as the outreach of extension services increased from 32% in 2011 to 69% in 2015 (MINAGRI 2018). Access to extension services was important in advancing the dissemination and adoption of improved seeds and fertilizers.

Introducing new seed to smallholder farmers

The 1991 World Bank review of the agricultural sector in Rwanda showed that only 5% of farmers accessed improved seeds (World Bank 1991). The already struggling seed sector was disrupted by the 1994 genocide that devastated all forms of social and economic activities. In the seasons that followed the genocide, people struggled to find food and planting material. Seed aid was received through different organizations, particularly the Seed of Hope organization (SOH) (Buruchara et al. 2002). Through collaboration with the national researchers, SOH sought to recover the indigenous seed and planting material that had been lost. Despite the loss of planting material and scientists, by 2001 ISAR had regained the capacity to produce and supply seed to farmers. However, as indicated by the PRSP1, in 2002 only 1% of the population accessed improved seed varieties (Buruchara et al. 2002).

The small proportion of farmers accessing improved seeds shows that farmers depended on informal seedsystems for planting material. In the informal system, farmers' saved seed is exchanged between communities and traded without government involvement. However, having been traded over a long time, informal seed can sometimes be of poor quality (Almekinders 2000). For this reason CIP aimed to promote the formal seed sector to farmers.

Through CIP the Government mobilized improved seed for the prioritized 6 staple crops: maize, beans, Irish potatoes, cassava, banana and wheat. Given the limited supply of high yielding seed for these crops in the country, CIP imported planting material from neighbouring countries. From the first CIP season in 2007, 400T of maize, 400T of Irish potatoes and 60T of wheat were imported, while 5 million cassava cuttings were purchased from local seed producers (MINAGRI 2009). As CIP was rolled out and farmers learned about the new technologies, there was increased seed demand, which led to more imports. For instance, from 400T of maize in 2007, importation increased to 1227T in 2010, (MINAGRI 2007).

The government-monopolized seed supply through the Rwanda Agricultural Board (RAB) and CIP. Seed for prioritised crops particularly maize was given to farmers for free as an incentive to buy chemical fertilizers. Both seeds and fertilizers were supplied as a package, in most cases deposited at a public storage location, mainly at a sector office where the inputs would be disseminated to farmers.

Tackling the issue of declining soil quality and fertility

As already stated in previous sections, Rwanda's soil conditions declined over time, driven by population pressure.[16] Land scarcity has limited farmer's ability to leave land fallow, while the reduction of livestock reduced the use of cow manure for fertility.[17] Overtime, continuous cultivation with minimum nourishment degraded the soil. Although introduced in the 1970s, chemical fertilizers were not widely used by farmers in the 1980s and 1990s. It was believed that Rwanda's soils were fertile and fertility could be maintained by food production through crop rotation, fallowing and the use of manure (Kelly et al. 2001). Given that conviction, and the fact that importation was costly, the government was reluctant to promote the use of fertilizers. Consequently, fertilizer usage in the 1980s was less than a kilogram per hectare cultivated, the lowest in the world (World Bank 1991). Ironically, the available fertilizer was almost exclusively used to increased output for cash crops.

In contrast with the earlier approaches, government policies after 2000 favoured the use of modern inputs, including chemical fertilizers for both cash and food crops. At the time, countries like Malawi were generating impressive yield increases through fertilizer subsidy programs, particularly for maize (Dorward, Chirwa, and Jayne 2011). Fertilizer application has been found to account for more than half of crop yield increases, particularly in cereals (Roberts 1999). While fertilizer usage in Rwanda was low (2.9kgs/ha of cultivated land in 2000), studies showed that usage could increase if the government invested in building the capacity of farmers, and promoted increased supply (Kelly and Murekezi 2000). Through CIP, farmers were encouraged to use the already tested DAP, Urea and NPK (17-17 -17) chemical fertilizers supplied through a subsidy program.

---

[16] See Chapter 2, Section1 on agriculture before the 2000 reforms

[17] Ibid

Similar to seed supply, importation of chemical fertilizers increased from 22,000T in 2007 (MINAGRI 2007), and had doubled to 44,000T in only three years (MINAGRI 2011c). Fertilizer demand was motivated by the government crop-based fertilizer subsidy: fertilizer was offered at 50% of the retail price to make it affordable for farmers. Farmers' access to chemical fertilizer was through a voucher system that limited fertilizer use to CIP prioritized crops. Distribution was through a network of private companies selected through an auction set up by MINAGRI (MINAGRI 2008). Fertilizer use had increased from 2.9kg/hectare in 2000(Kelly and Murekezi 2000) to 39kg/hectare in 2017 (GoR 2018). This is still below the recommended 50kg/ha recommended by the African Union as an acceptable level of application that would increase productivity and not be detrimental to the environment (African Union 2006).

Modern inputs were integrated with the use of cow manure. In the year CIP was launched, the government introduced the One Cow per Poor Household Program, which intended to diversify house income and reduce poverty. In this program, poor households receive a cow (MINAGRI 2014a). Having a cow increases the ability of a household to earn more income through the sale of milk, and improve land productivity through the use of manure. It was anticipated that farmers with a cow were more likely to integrate the use of manure and chemical fertilisers to restore soil fertility. However, farmers were only eligible to use chemical fertilizers through CIP if they had consolidated land use towards prioritized crops.

2.3.2 Institutions influencing land use and tenure security

Land consolidation is often a response to land fragmentation. Land fragmentation in Rwanda is a result of severe land scarcity and the inheritance culture (Ngoga 2018). Agriculture, therefore, comprises of millions of small farms with an almost complete absence of large-scale farming. In Rwanda, land consolidation was mentioned in PRSP and PSTA1 as a strategy that could be used to increase efficient utilisation of highly fragmented land. In the 2005 National Land Law, MINAGRI, in conjunction with MINALOC, was given the mandate to authorize land consolidation as a mechanism for increasing land productivity (GoR 2005).

The Land Use Consolidation (LUC) model used in CIP is one where farmers in a given area grow prioritised crops while maintaining their land rights (Kathiresan 2011). Farmers within CIP who originally worked individually on small plots are encouraged to synchronize land use to facilitate access to extension services, technologies and markets. As a result, decisions about planting and selling are made cooperatively, to improve economies of scale, visibility and access to services. Despite the many benefits, some farmers were cautious about LUC when the policy was first launched.

Studies have shown that farmers in the LUC program were more likely to increase land productivity (Nilsson 2018; Nyamulinda et al. 2014). For that reason, LUC continues to be one of the key programs promoted for agricultural transformation in Rwanda. However, given the post-conflict history of Rwanda, individual land rights were an important factor to be considered while promoting cooperative land use (Kathiresan 2011).

It is therefore not surprising that the land policy was launched in the same period as the agricultural reforms. The land policy of 2004 was an important step towards safeguarding individual land rights and improving the lives of rural communities. The key features of the land policy which are closely related to agriculture include the establishment of a master plan for land use (not implemented yet), equal rights to land for both men and women, and mandatory registration of individual parcels (GoR 2004b). Land regularization was piloted in 2007 and completed 5 years later, with 11 million parcels of land registered (Ngoga 2018).

The fact that the registration process involved local communities, local leaders and district-based land centre staff made land registration cost-effective and affordable for farmers (Ngoga 2018; Pritchard 2013). For instance, local participation facilitated quick resolution of conflict, therefore preventing unnecessary delays. In addition, the hiring of local and cheap surveyors lowered the cost of registering land. The land regularization reforms in Rwanda have shown a positive impact on women's empowerment, land tenure security, and investment (Ali, Deininger, and Goldstein 2014). It was envisaged that one of the impacts of the land policy would be to increase long-term investment in land, including mitigating the effects of soil erosion and effects of climate change (GoR 2004b). Managing soil and water to increase land productivity has been an integral part of developing smallholder agriculture in a sustainable manner. The next section discusses policies and initiatives developed to control hillside soil erosion and manage water for irrigation.

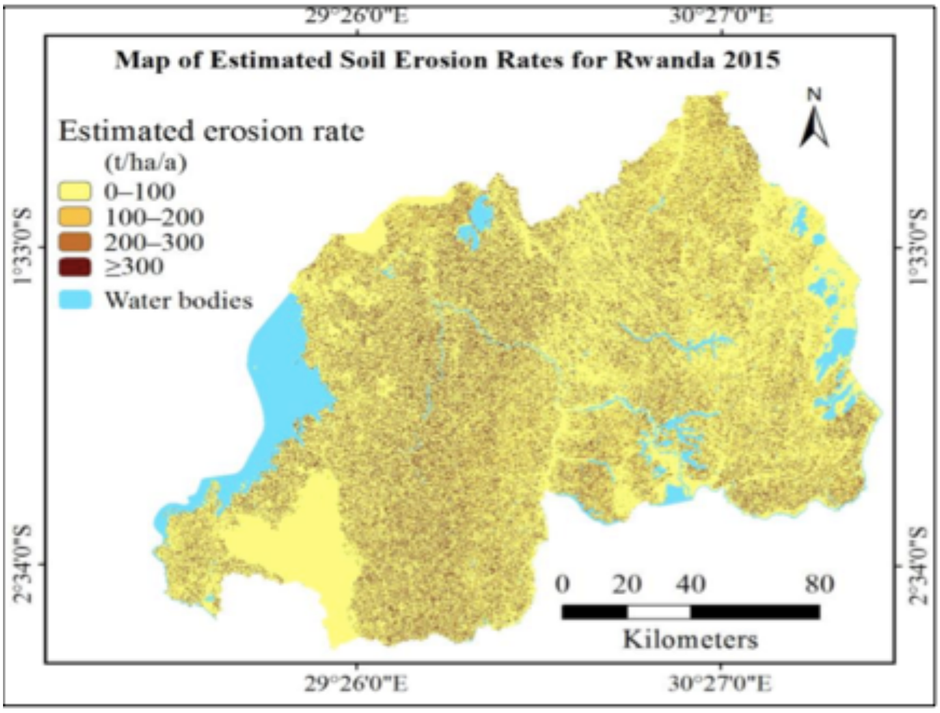
2.3.3 Soil and water management models

Reforms after 2000 emphasize an agricultural development approach that is sustainable, implemented in an environmentally friendly manner. One way used to promote sustainable farming systems is to support farmers to control soil erosion and introduce methods for water harvesting and management for agriculture. The donor funded Rural Sector Support Project (RSSP) and the Land Husbandry, Water Harvesting and Hillside Irrigation Project (LWH), are key programs in MINAGRI dedicated to tackling the issue of soil erosion and limited irrigation. This has become particularly important with reducing land size and increasing weather volatility.

Techniques for soil erosion control

Rwanda is known as the land of 1000 hills. These hills, which display the beauty of Rwanda, also pose the greatest challenge to agricultural development. As shown in previous sections, in addition to having small and scattered holdings, most households farm on steep hillsides are prone to soil erosion.

Figure 2.2: Rwanda soil erosion map 2015



Source: Karamage et al. (2016)

Karamage et al. (2016) found that each year an average of 27 t/ha/a of suitable agricultural soil is lost, transported by streams and rivers to other locations. Their study shows that 24% of the croplands in Rwanda have a soil erosion rate greater than 300 t/ha/a (Figure 2.2), indicating their unsuitability for cultivation. Yet, with an increasing population, farmers continue to expand food cultivation to more fragile and marginal land. The battle against soil erosion in Rwanda began as far back as the 1950s with the construction of ditches and hedges along hillsides.[18]

The traditional way of controlling soil erosion is planting trees, building ditches and grass around them to check the velocity of water along the hills (Clay and Lewis 1990). The grass planted round the ditches to improve their efficiency may serve as forage for livestock or mulch for fields. Gradually the grass creates a hedge effect that becomes a soil barrier. As soil movement is

[18] Section 2.1 highlights that fighting soil erosion started during colonial era.

from the top to the lower part of the field, the lower part of the field is often more productive than the upper part (Kagabo et al. 2013). Over time, soil tends to build behind the live hedge creating a terrace effect, which is known as progressive terracing.

Combining drainage ditches, grass strips, and forestation has been found to reduce soil erosion by 57% (Kagabo et al. 2013), but the technique is limited in inducing soil fertility. Bench terraces that involve both soil erosion control techniques and fertility measures have been found to control soil erosion and reduce soil fertility gradient.

Bench terracing is one of the soil conserving techniques effective for soil improvement (Ndayizeye 1997). This is because most terracing programs provide farmers with a package that includes manure and chemical fertilizers. Through the LWH program farmers are provided with a menu of different soil management techniques that include water management.

The new LWH husbandry model that encompasses traditional and conventional approaches to soil and water management has been introduced to farmers (MINAGRI 2011). The project developed a comprehensive land husbandry approach recommending soil management techniques for different slope categories.[19] The project uses a participatory approach where thousands of people including landowners and community members are trained and hired to build land management structures in the selected watersheds (Figure 2.3).

---

[19] Technologies recommended for slopes below 16% include grass strips, while for slopes greater than 16% construction of soil bands, terraces, and waterways and check dams are recommended. Agroforestry is suggested for all slope categories planted along the terrace embankment. Forests and zero tillage are recommended for land above 60% slope. Soil fertility techniques include composting (10tn/ha) and liming (2tn/ha) for soil restoration after terracing.

Figure 2.3: Communities in Nyanza constructing terraces

Source: Author's own

An analysis of the LWH approach shows that in some areas, the comprehensive land husbandry approach had reduced soil loss by 98% only 4 years after implementation (LWH 2015). In just three years, the project had expanded to 15 districts, financed treatment of more than 10,000ha of land and benefited more than 200,000 people (MINAGRI 2013). Additionally, about 17% of this land was marginal land, unfit for agriculture but restored to fertility (LWH 2015). Project studies show that most farmers engaging in comprehensive land and water management doubled crop yields in just the first year of this program (LWH 2017).

Developing models of water management

Irrigation not only facilitates greater responses to improved technologies like seeds and fertilizers, it also reduces the risk of crop failure. A lack of water, particularly during the critical period of the plant growth cycle, drastically affects yield (Ndamani and Watanabe 2015). It has been shown that irrigation has the potential to boost agricultural productivity by 50% and ensure a reliable supply of food (IFPRI 2010). Therefore, irrigation is a critical part of building resilience among farmers who are increasingly dealing with unpredictable weather patterns. Over the period of the study, the land under irrigation increased to more than six times (IPAR 2009; MINAGRI 2018). It was therefore critical to encourage the formation of grassroots institutions that manage irrigation water and infrastructure.

Rwanda has a number of water resources that could be harnessed for irrigation (GoR 2010). Irrigation is especially critical in the eastern and southern part of the country where most areas are prone to droughts and inadequate rainfall. Most of the potential areas for irrigation are in marshlands. Irrigated marshlands are particularly used for rice production (Fig 2.4)

Figure 2.4: Picture showing marshland rice irrigation

Source: Author's own

In 2000, the government tagged marshland development as an easily achievable target, with the potential to provide irrigation and raise food production for rural farmers (GoR 2002). This was mainly done through the RSSP project. Typically, marshland irrigation involves the construction of earth fill dams or stream diversion structures for harvesting water, and gravity irrigation systems using canals or pipes, outlet structures and valves. These irrigation schemes range from 45 to 1500 hectares. With irrigation farmers produce rice twice a year with an average yield of 6T/ha each season.

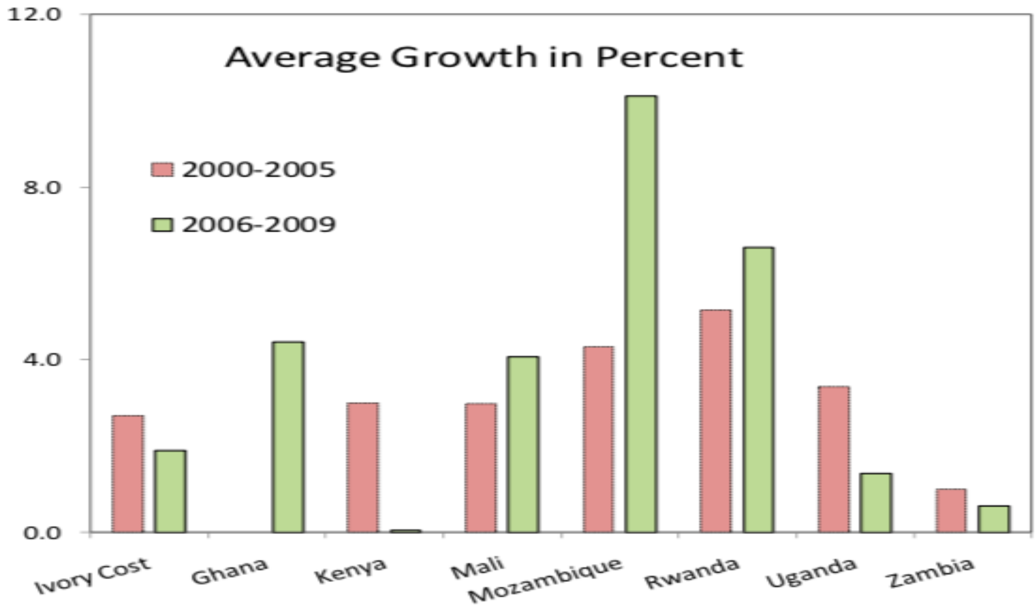
Most of the cooperatives have contracts to supply paddies to rice millers who have strategically bought mills near irrigated schemes.

After more than 10 years of building dams, Rwanda had mastered the technical aspects of dam construction at the MINAGRI, private sector and community levels. However, the challenge was building sustainable water and infrastructure management models at the grassroots level, to enable returns on investment. A study commissioned in 2009 found that the model used, where cooperatives manage both the production and water aspects of the irrigation scheme, was not working (Diemer 2009). Cooperatives lacked the capacity to efficiently organize production, manage water, collect fees and maintain irrigation infrastructure. As a result, water management issues in these marshlands became a major cause of conflict and limited the expected yield benefit to farmers. To address the issue, the Water Users Association (WUA) model for water management was proposed.

In 2012, the Government, through a ministerial order issued in the Official Gazette No 50 of 12/12/2011, made WUAs mandatory in all irrigation schemes in Rwanda. After 2012, all water users in irrigation schemes were required to form WUAs and take full responsibility for the management, enhancement and maintenance of the water resource. MINAGRI, through RSSP and in conjunction with district technical staff, introduced the WUA concept to farmers. RSSP spearheaded this activity and organized workshops and training sessions for district technical staff, local leaders and farmers' representatives to explain this water management concept. By the end of 2013, most WUA had streamlined water distribution and management which began to reliably increase yields and reliably grow rice throughout the year.[20]

[20] See chapter 7 section 2 for details on the WUA model in Rwanda

Figure 2.5: Comparing agricultural growth in Rwanda with other countries



Source: World Bank 2011

In the period between 2006-2010, agriculture registered an average annual growth rate of 5.2%, and an even higher growth in food production of 7%, meeting both Vision 2020 and CAADP targets (World Bank 2011b). As a result, Rwanda continued to perform well in agriculture compared to other countries in the region (Figure 2.5). In the same period average annual GDP growth rate reached the desired 8% target (GoR 2011b), while poverty dropped from 56.9% in 2005/2006 to 44.9% in 2010. This impressive economic performance can be partly credited to agriculture. In fact, the World Bank attributes 45% of the poverty reduction between 2000 and 2010 to agriculture (World Bank 2013).

The major distinction between policies in stage and 1 and 2, is that in stage 2, the policies and programs developed were specific and aimed to incentivise increased food production. Another key factor is that these policies also targeted poor farmers. For instance, CIP which is the major policy in MINAGRI focused on smallholder food producers; the one cow program was created for poor families; the cooperative and land use consolidation policies encouraged collective action and inclusiveness; and the land policy that provided land rights to all Rwandans. These policies provided practical solutions to some of the fundamental problems in agriculture that rural farmers face, including lack of information, technologies, finance, markets, limited tenure security. As a result, the country achieved greater improvement in agriculture. During stage 1 and 2 the government spearheaded agricultural change with strategies to attract more private sector engagement mainly. The next section examines stage 3 where the private sector engagement took a more central role.

2.4 Stage 3: Changing to market-led systems – attracting private sector investment

This section surveys the period between 2010 and 2015, to underscore the steps taken toward increased commercialisation and private sector engagement in agriculture. While the government continued the implementation of the policies launched in stage and 1 and 2, the new policies in stage 3 of agricultural development emphasized market development and more private sector engagement. As such, policies that address issues of postharvest, output and input trade were formulated. Table 2.4 shows the main policies developed in this period.

Table 2.4: Policies related to agriculture between 2011 and 2015

Period	Year	Policy/Main objective
2011-2015	2011	**National Post-Harvest Staple Crop Strategy:** Improve postharvest and trade and food security. National strategic reserve constructed
	2014	**National Private Sector Development Strategy** Address key constraints to private sector development
	2015	**National Fertilizer Policy** Support fertilizer trade and distribution
		National seed Policy Support the seed trade and distribution

Sources: MINAGRI, MINICOM

2.4.1 Minimizing postharvest losses and facilitating farmers' access to markets

The previous section demonstrated how the Government's concerted efforts to improve agriculture led to significant technical changes and increased yield. For example, rice yield in the RSSP irrigated marshlands doubled, maize yield quadrupled, while wheat increased 2.5 times (GoR 2013). In fact, for the first time in decades, in 2008 MINAGRI reported food production that exceeded consumption (MINAGRI 2008). Yet, at the time, Rwanda's food storage capacity was approximately 12,000MT, far below what was needed. As farmers produced more and started to rely on the market, the need for postharvest knowledge and infrastructure became paramount.

In 2010, MINAGRI formed the Post Harvest Handling and Storage (PHHS) taskforce to address increasing issues related to the lack of postharvest facilities and markets for farmers (MINAGRI 2012). Through collaboration with districts, Community Village Postharvest Initiatives (CVPI) started, mostly in high production areas, to minimize crop losses for farmers after harvest. Thousands of materials were supplied to communities to construct temporary and semi-permanent facilities for grain drying and storage, providing crop-holding areas to avoid the necessity of selling during harvest when prices are low. In 2011, MINAGRI finalized the National Postharvest Staple Crop Strategy, which provided a framework to support postharvest initiatives, private sector engagement and trade.

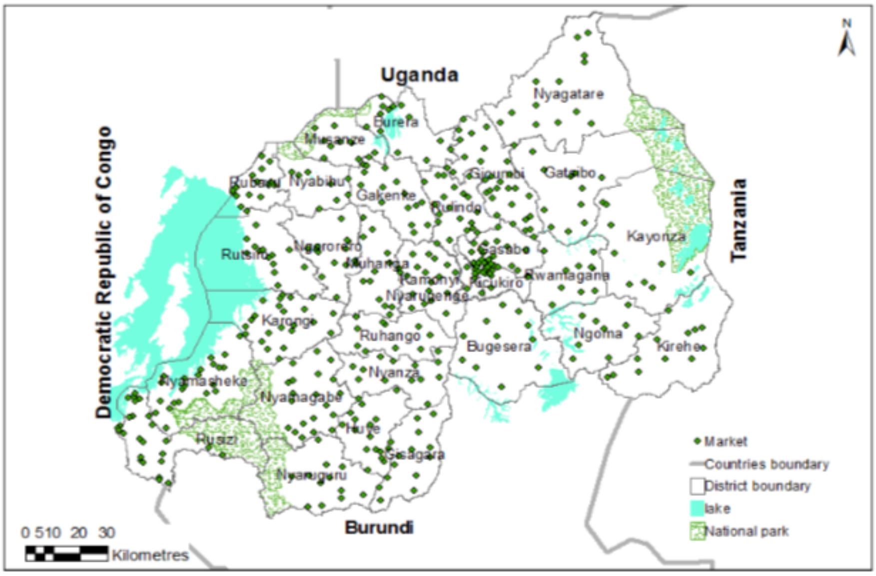
Traditionally, food trade was conducted informally with most farmers selling produce to neighbours, petty traders and unregistered mills. For instance, in 2010 less than 20% of the maize produced was sold through structured formal markets (MINAGRI 2012). It was anticipated that with an increasing number of agricultural cooperatives, formal trading would emerge, introducing farmers to more lucrative markets. Both MINAGRI and the ministry of Trade and Industry (MINICOM) trained farmers' cooperatives in business skills and contract management to equip them with the knowledge needed to engage in external markets. In 2012/2013 MINICOM reported that the ministry had trained more than 160 cooperatives involved in CIP on how to conduct agricultural businesses (MINICON 2013).

Other players joined the produce market, particularly the grain trade. First, MINAGRI installed a National Strategic Food reserve facility that bought grain from farmers for the national emergency food stock reserves (MINAGRI 2010b). Then, in 2011, Rwanda Grain and Cereal Cooperation (RGCC) was approved, a Public Private Partnership (PPP) meant to enhance grain trading (MINICON 2013). Subsequently, other players, including the East African Commodity Exchange (EAX), Eastern African Grain Council (EAGC), and the World Food Program (WFP), joined the Rwandan grain markets, mainly dealing with farmer cooperatives and traders.

The growing grain market, particularly for maize and beans, led to increased numbers of local traders in agricultural products. For instance, in just a year EAX had increased trading volume by more than five times from 2000MT in 2013 to 11,500MT in 2014 (MINICOM 2015). In the same period MINAGRI purchased close to 10,000MT of grain (MINAGRI 2014). As such, MINICOM reported an unprecedented number of supply contracts: 358 were signed between farmers, processors and buyers of maize, cassava, Irish potatoes and dairy in 2014 (MINICOM 2014). That figure excludes other local transactions, particularly those in rural markets where most agricultural trade happens.

In most places in Rwanda it takes less than 2 hours to reach a market and most of them are accessible all year round by transport other than walking (Figure 2.6) (WFP 2015). Figure 2.6 show the location of markets in Rwanda. Similarly, most farmers live near a road. Out of the 30 districts, the ones with the highest percentage of households located far away from roads (>5km) are Gakenke, Nyagatare, Gatsibo (included in this study) and Kirehe. Since most people are close to a road, accessibility of farmers in Rwanda makes it ideal for agricultural input and output trade.

Figure 2.6: Map showing the location of markets in Rwanda



Source: CFSVA 2015

Privatization of Fertilizer and Seed Distribution

To encourage private sector participation in agriculture and reduce the government budget for input, it was necessary for the government to withdraw from fertilizer and seed purchase. Therefore in 2013, MINAGRI decided to move from the role of fertilizer and seed distribution to that of a facilitator (MINAGRI 2013).

By the time of privatization, annual fertilizer demand had increased from 6,000 metric tons in 2006 to 34,000 metric tons in 2012 (USAID 2012). Also, the fertilizer credit system for distributors that had been supported by MINAGRI for 4 years was waived in order to move to increased cash sales arrangements, a signal that the ministry had generated sufficient fertilizer demand to sustain private sector interest (MINAGRI 2015). After privatization, fertilizer prices to farmers were adjusted to reflect the new and reduced subsidy arrangement since the 50% transport subsidy was removed to cut government costs (IFDC 2014). Prices per kilogram of DAP, NPK and Urea that ranged between 240-440 Rwandan Francs now fluctuated between 420-560

Rwandan Francs. For example, the subsidized price of DAP for maize growers doubled from 240 Rwf (£0.24) in 2012 (USAID 2012). In the new structure, fertilizer was imported by a few selected companies and distributed through a network trader, 19 distributors (bulk buyers) and 1062 agro-dealers (retailers) (MINAGRI 2015).

As with fertilizers, there was increased private sector engagement in the seed sector, and the free seed policy was removed. The growing demand for hybrid seed attracted more private sector involvement in local seed production (Table 2.5). A significant increase in private seed companies' investment in growing certified and Quality Declared Seed (QDS) locally was most noticeable, particularly for maize after 2010 (Van den Broek and Byakweli 2014). Other companies continued to import seed to satisfy the demands of farmers. Seed and fertilizer suppliers work together so that farmers have the needed input package each season.

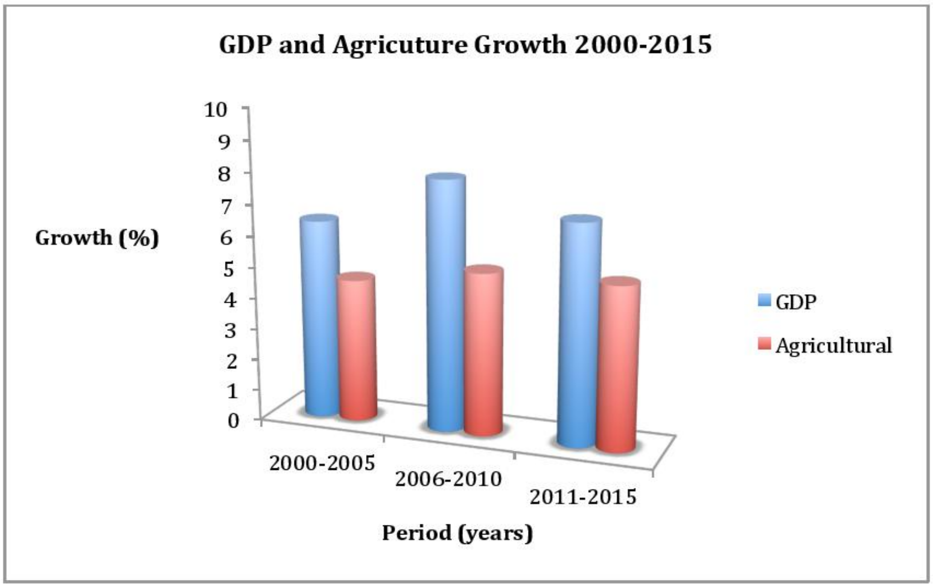
Table 2.5: Increase in the production of local commercial certified seed (MT) form 2006-2013

	2006	2007	2008	2009	2010	2011	2012	2013
Maize	231	458	337	509	1.391	5.794	5.760	7.123
Wheat	22	72	61	79	33	136	372	32
Rice	11	197	101	206	200	206	70	18
Beans	46	80	89	108	121	1.244	869	133
Soybean	0	16	37	19	121	136	359	664
I. Potato	196	1.965	1.403	905	1.531	2.062	2.809	2.925

Sources : van den Broek and Byakweli 2014

Figure 2.7 shows that in Stage 3, Rwanda maintained strong economic performance with an average annual growth rate of GDP at 7%, and agricultural growth at 5.2%.[21] By 2014, the poverty rate had reduced to 39.1% of the population (GoR 2014).[22]

Figure 2.7: GDP and agricultural growth in 2011-2015



Source: NISR National Accounts 2016-2017

There are several policy changes and institutions developed in this period to enable and motivate increased productivity and commercialisation among smallholders. Chapter 6, 7, 8 examines factors that influenced increased productivity and commercialisation from the farmers' perspective.

2.5 Summary

Agriculture in Rwanda evolved over many decades, driven by changes in institutions, population growth, policy, and technology. Having emerged from a long history of ethnic division and the terrible genocide, policy makers in Rwanda understood that social and economic development would not be achieved without addressing the questions of food insecurity and poverty.

21 Economic performance in this period was affected by the suspension of donors' funds in 2012/2013, due to geopolitical political inquiries

[22] 64% of the population was in poverty in 2000.

Agriculture was therefore promoted by the government as the core driver of poverty reduction and economic development.

State-led policies determined the agricultural development trajectory during the period of the study. The main driver of agrarian change was the Crop Intensification program that focused on improving agricultural productivity for rural smallholder food producers. Some of the instruments used, like the Land Use Consolidation, were designed to address issues specific to Rwanda, e.g. severe land scarcity and soil infertility and degradation due to soil erosion.

The evidence highlighted in this chapter shows that Rwanda's approaches and strategies worked. It was only after 2000 when smallholder agriculture became a primary focus that Rwanda started to register significant increases in food production, poverty reduction, and economic growth. The unprecedented growth in agriculture observed after 2000 can be attributed to consistent political commitment to the sector, comprehensive and supportive policies at a national and global level. It is important to note that agricultural systems evolved in the context of the sweeping economic changes that occurred at the same time.

The finding in this chapter links to a body of literature that recommends agriculture as a critical driver of economic growth and poverty reduction (Timmer 2005; De Janvry and Sadoulet 2010). Rwanda's process ties in well with the pro-poor agricultural development model suggested by Dorward et al. (2004) that involves careful government policy sequencing to increase crop productivity and stimulate markets. Policy instruments and institutional arrangements were modified and refined over time to facilitate the move from state-led agricultural development to a more market-driven system.

Having shown Rwanda's approaches in this chapter, the next chapter reviews the literature on smallholder agricultural development in the global setting to understand conditions under which other countries have generated growth in output.

Chapter 3: The Emerging Smallholder Agricultural sector in Africa

Having discussed Rwanda's specific agricultural development path, this chapter draws from various bodies of literature to outline the rationale for prioritizing agriculture and to gain an understanding of why some countries have generated agricultural growth and others have not. To derive a deeper understanding of the agricultural development process, one has to view agriculture in economic development from a historical and social perspective.

The literature review is divided into 4 sections. Section 3.1 explores the historical evolution of views on the wider role of smallholder agriculture in economic development, relative to export-oriented cash crops. This is related to the thinking of Lewis, Prebisch-Singer, and others in the 1950s, who largely neglected agriculture. The section discusses some of the reasons why smallholder agricultural development in Africa lagged behind.

Section 3.2 reviews the literature on pathways of agricultural development, particularly during the initial stages of economic transition. It shows that while some countries attained an agricultural revolution by adopting simple organic farming systems others employed conventional methods that involved advanced productive inputs.

Section 3.3 discusses the uprising in smallholder agriculture in Africa and the approaches being used to facilitate increased food production and reduce hunger. Looking at Rwanda the section examines some of the questions raised about the approaches taken to generate growth in agriculture.

Section 3.4 sheds light on the enablers of agricultural change. It uses an framework of institutional economics to examine the role of several institutions to reduce transaction costs and improve availability of information to facilitate smallholder agriculture development. Institutions considered in this section are those that facilitate access to information, access to input and output markets, access finance, access to land, and collective action.

3.1 African policy for smallholder farmers: the bias towards cash crops

Rwanda's agricultural development trajectory is closely linked to that of many African countries. Like Rwanda, in most countries, smallholder-based food production is the largest subsector in agriculture. Yet for decades this sector received limited attention from policy makers. Due to this neglect, and radical population increases, the once thriving traditional food systems can no longer sustain adequate food supply. It was only in the earlier 2000s, as countries continued to contend with persistent rural hunger and poverty, that policy makers turned their attention to smallholder farming. Despite the shift in focus, most African countries still struggle to design appropriate food policies that support rural smallholder farmers to sustainably increase food production. This section restates, from a policy perspective, some of the reasons why smallholder food production in Africa has lagged behind, and recent efforts to revive the sector.

The story of African agriculture is a story of how this particular sector has been regarded from pre-colonial times up to the present day. In pre-colonial times, African societies engaged in subsistence food production, which was a central part of people's social and cultural life (Vansina 1979). Growth in agriculture was achieved through shifting cultivation and the introduction of new food crops through trade. These pre-colonial farming systems were significantly altered by colonialism, which introduced the cultivation of the cash crop to meet the needs of foreign industries.

This paradigm shift led to a dual agriculture structure with the smallholder traditional[23] food sector on one hand and export-oriented agriculture on the other (Thorbecke (1980). Extensification policies enabled farmers to expand the area under cultivation, which sustained both the export and food sectors. In fact, in the 1960s, when Asia was caught in a food crisis, African countries were self-sufficient in food (Eicher and Staatz 1985; World Bank 1981). However, the thinking at the time was that the future of African lay not in rural agriculture but in urbanization.

The bias towards industrialisation was reflected in the views of economists such as Prebisch-Singer (1950) and Lewis (1954), who associated agriculture with backwardness, and believed that industrialization was the main pathway to modernization. Lewis assumed that labour in agriculture is unproductive and unlimited. Therefore, drawing redundant manpower from the subsistence agricultural sector towards a more vibrant industry would help to build a highly productive, industrialized, economy. This thinking, embedded in colonial policy, led to an emphasis on industrialisation, and export-led growth models of economic development (Darkoh and Ould-Mey 1992).

In most cases post-colonial leaders adopted the mechanisms used by their colonial predecessors with the motivation to stay in power rather than to advance the state (Herbst, 2000). Governments maintained the status quo after independence by continuing to uphold these export-oriented policies (Darkoh and Ould-Mey 1992; Delgado and Mellor 1984; Thorbecke 1980). This was fueled by the need for foreign exchange, taxes, and political backing (Kaberuka 1987; Bates 1981). According to Bates (1981), the agricultural policy was influenced by political systems whose motivation was to confer

[23] Traditional agriculture in this thesis means a form of farming that has been used for many generations that involve indigenous knowledge, traditional tools and cultural beliefs.

benefits upon the urban elite while imposing costs to those living in rural areas, particularly poor farmers.

Government intervention into agriculture was through state-supported Marketing Boards (Gbetibouo and Delgado 1984; Williams 1953). These boards facilitated farmers' access to inputs, loans, advice, and markets. However, Marketing Boards were export-oriented and very few supported smallholder food producers (Jones 1987). By 1970, it was evident that this model was not effective, since agricultural output was declining and many African countries were food insecure (FAO 1978).

Without discounting environmental and political factors, it has been widely argued that the primary root of Africa's food insecurity problem stems from the lack of policy prioritization and investment in agriculture, particularly in the staple food sector (see for example Darkoh 1989; Nyanjom 2013; Clover 2003; Lele and Agarwal 1989; and Darkoh 1989). Despite recurrent food shortages in most parts of the continent, governments remained reluctant to formulate national food policies. Meanwhile, rapid urbanization and massive migration of labor to the more recruited urban sector led to a labour shortage in agriculture (Delgado and Mellor 1984), contrary to Lewis' model of unlimited labour supply in agriculture. It is the focus on industrialization without fully emerging from agricultural subsistence systems that trapped Africa in poverty, food insecurity and slow economic progress (Funnel 1988). In a 1981 report, the World Bank called for action because while the African population was growing rapidly, food production was reducing (World Bank 1981).

According to the World Bank, the regression of agriculture was caused by weak and inefficient government systems, and distortions and improper working of the market (World Bank 1981). In response to these issues, in the 1980s, the World Bank, together with the IMF, prescribed Structural Adjustment policies (SAP), which emphasized reduction of government intervention and market liberalization. Consequently, governments phased out Marketing Boards and withdrew support that enabled rural farmers to access input and output markets (Bryceson et al. 2010, Havnevik et al. 2007). After dismantling the existing government-supported marketing systems, the private sector did not live up to the expectation that it would take over these functions (DIFID 2005, Kherallah et al. 2002). Zeleza (1989) showed that SAP policies were detrimental to agriculture and to African economies in general.

Global 'urban biases', embodied in development policies, inadvertently led African countries to a trajectory of limited agricultural growth. While Asian countries focused on agriculture and rural development and made major strides towards poverty reduction and economic development, in Africa where support for farming was limited, hunger and rural poverty have prevailed (Henley and Kees Van Donge 2013). The next section considers by way of comparison how some developed countries historically stimulated agricultural growth during their initial stages of development.

3.2 Stimulating growth in agriculture: Examples of success

Drawing from global experiences, this section examines the literature on Britain and Asia, where two regions followed different pathways to stimulate agricultural growth during the initial stages of agricultural development.

As far back as the 18th century, Britain's intensive agricultural systems supported increased food production for industrialized communities (Starr 1941). Depending entirely on their own efforts, over time farmers found ways of increasing soil fertility and introducing new cropping systems. Instead of leaving land idle – as had occurred with the ancient farming system of leaving the land bare one year out of three – growing turnips in the winter farrowing period increased soil fertility while providing fodder for livestock. This 'new husbandry' of integrating crops and livestock production increased manure for soil improvement and crop output and is reported as an agricultural revolution (Timmer 1969; Slicher Van Bath 1969). The ‘new land husbandry’ increased yields and had the potential to sustain a 1% annual agriculture growth for a long time (Hayami and Ruttan 1971). Agricultural output continued to expand and support the industrial revolution (Slicher Van Bath 1969). Subsequently, more drastic agricultural changes were witnessed through science-based innovations that increased land productivity.

Many have written about the spectacular increases in agricultural output in India in the 1960s; see for example, Parayil (1992); Randhawa (1977); and Chakravarti (1973). With high populations, an imminent danger of famine, and limited land, the key option for Asian countries was to promote agricultural intensification systems to increase food production. Research collaborations with America made it possible for farmers in Asia to access high yielding rice and wheat varieties (Parayil 1992). To support the adoption of these new technologies the government of India was heavily involved in providing subsidies, extension services, rural finance and marketing activities. With state support, the short and stiff, straw high yielding wheat and rice varieties were introduced to farmers, particularly those farming in irrigated areas. Fortunately, the country had been investing in the tubewell irrigation technology since the 1950s (Dhawan 1979).

The technology package that included improved seed varieties, chemical fertilizers and irrigation led to radical increases in output for farmers in Asia. For instance, the amount of wheat produced in South Asia tripled between 1963 and 1972 (Farmer 1981). Along with the increase of agricultural productivity came increased demand for labour, and a reduction in food prices (Singh 1990). The success of the new technologies was the foundation of the famous ‘Green Revolution’ (GR) in the 1960s. Despite the success, the benefits of the GR were mixed.

While richer and larger farmers extensively used the new technologies and, increased yields, poor and small-scale farmers grappled with adoption and lagged behind (Frankel 1971). Given limited resources, smallholder farmers had difficulties investing in the new inputs, particularly irrigation, which was a precondition for accessing new technologies (Chakravarti 1973). In contrast, larger farmers who already owned private tubewells became the early adopters gaining the most from GR. However, looking at the case of North Arcot district in India, Hazzel and Ramasamy (1991) found that, although smallholder farmers had greater difficulties during the initial stages of the GR, most had adopted the technologies by the 1980s and 1990s. This experience attests to the fact that smallholder agricultural development is a much more complex process, requiring specific state interventions to remove barriers to agricultural advancement (Dorward, Marrison, and Urey 2004; Kirsten et al. 2009; Lele and Agarwal 1989). It is worth noting that although the GR provided an opportunity for farmers to increase food and income, the substantial use of agro-chemicals posed environmental concerns (Pimentel and Pimentel 1990).

The examples described in this section show that agricultural intensification through the organic farming system used in Britain and the conventional methods in Asia, both generated increases in agricultural output. However, it is important to note that much higher yield increases were achieved in Asia where farmers used hybrid seed varieties, chemical fertilizers and irrigation. Also, in Britain, agricultural change occurred over a long time, induced by farmers who independently adopted new farming techniques. This was contrary to the more drastic changes witnessed in Asia, where governments supported technology dissemination and adoption. Despite government support, the GR experience shows that the transition to new and capital-intensive technologies can be more challenging for smallholder farmers. Additionally, contemporary ways of increasing productivity can degrade the very natural resources on which they rely on.

The reality is that most African farmers still engage in traditional organic farming systems similar to those described in Britain in the 18th century.[24] As noted, these organic systems lead to conservative levels of agricultural growth and change occurs only over a long period of time. With increasing pressure to feed the growing population (under conditions similar to those in Asia in the 1960s), in a context of of reducing land size per family, and climate change, African countries have the occasion to develop a menu of approaches that generate rapid outcomes and reduce poverty and hunger while protecting the environment.

3.3 Lessons from the past: The emerging smallholder sector in Africa

Within Sub-Saharan Africa the concept of a 'hunger season' is well understood: see for example case stories told by World Food Programme on their website[25] or the writings of journalists, such as Thurow (2013). Thurow captures vividly the predicament of subsistence farmers battling for a livelihood in the face of harsh conditions, and with inadequate resources:

> 'Africa's smallholder farmers, most of whom are women, know misery. They toil in a time warp, living and working essentially as their forebears did a century ago. With tired seeds, meagre soil nutrition, primitive storage facilities, wretched roads, and no capital or credit, they harvest less than one-quarter the yields of Western farmers. The romantic ideal of African farmers—rural villagers in touch with nature, tending bucolic fields—is in reality a horror scene of malnourished children, backbreaking manual work, and profound hopelessness.

---

[24] See section 3.2.2 of this chapter

[25] https://www.wfpusa.org/stories/what-the-hunger-season-means-for-farmers-fighting-famine/#

> Growing food is their driving preoccupation, and still they don't have enough to feed their families throughout the year. The wanjala—the annual hunger season [in Kenya] that can stretch from one month to as many as eight or nine—abides' (Thurow 2013, Promotional extract).

Coping mechanisms during the hunger season include reducing food consumption through day to day rationing, and ultimately going without food for whole days at a time in order to survive until food availability increases again. As Thurlow puts it:

> 'Household food rations are cut and meals eliminated. Three meals become two, then one, and then on some days, none. Work in the fields slows, children drop out of school, the littlest battle for survival.' (Thurlow 2013, Prologue)

In countries where the growth of so many children is stunted it is easy to see how this grinding hardship and poverty creates intergenerational vulnerability as well as whole household and community vulnerability through the co-variant risk of difficult food production and few alternative livelihood strategies.

A starting point for reducing this kind of food poverty and insecurity is to try and strengthen farming at the household level: increasing the propensity to adopt higher-yielding strategies with the aim of reducing regular hunger, thereby eliminating the need for systematically going without food at individual mealtimes, or even for whole days at a time.

After the failure of SAP liberal policies, there was recognition that advancing agriculture, reducing food insecurity and poverty, is a complex task requiring a clear set of balanced national policies and the involvement of central government. Researchers advocated for increased state interventions, and conscious and strong policies to redeem African agriculture (see for example Hazell 2005; Timmer 2005; Swaminathan 1992; and Cohen 1980).

People began to grasp the fact that linkages originating from agricultural growth can generate significant growth in other sectors too. Spillovers from agricultural intensification have the potential to increase rural wages and income, thereby generating added demand for non-agricultural goods and services (Poulton and Lyon, 2009, Gollin, Parente, and Rogerson 2002; Timmer 1991; Mellor 1998). It is these synergies between rural agriculture and urban industry that lead to rapid improvement throughout the economy. Irz et al. (2001) estimated that an agricultural yield increase of one-third might reduce the number of people in poverty by a quarter or more. This is a revival of the argument made by Johnston and Mellor (1961) that, far from playing a passive role in development, agriculture contributes significantly to economic growth.

By the new millennium, African governments were beginning to recognise the vitality of agriculture and the fact that poverty reduction and economic growth are difficult to sustain without developing agriculture. In 2003, the African Union (AU) established the Comprehensive African Development Program (CAADP), through which countries were mobilized to focus on smallholder agricultural development as a mechanism to reduce hunger and poverty prevalent in many countries (African Union 2003).

During the Maputo declaration in 2003, African leaders endorsed the CAADP framework and agreed on general principles regarding agricultural development, which were embodied in unique goals (NEPAD 2003). For instance, countries pledged to allocate at least 10% of the annual budget for the agricultural sector, generate annual agricultural growth rates of not less than 6%, and pay particular attention to smallholder farmers. Subsequently, governments had the task of creating appropriate institutions and policies to generate such growth levels. However, progress towards those objectives in many countries has been slow.

In 2009, only Rwanda had completed the CAADP process (Zimmermann et al. 2009). Rwanda easily embraced CAADP because the government had prior ambitions to focus on agriculture as the foundation for poverty reduction and economic growth.[26] By 2012, the majority of African countries had aligned their policies to CAADP (Kimenyi, Routman, and Westbury 2012). While the attention to smallholder agriculture yielded positive results at a continental level and increased average growth to 3.8% between 2000 and 2012, performance at the country level was mixed (Pinto et al. 2014). Reports on CAADP highlight that countries found the process challenging, given the complexity and crossing cutting nature of the agricultural sector (CAADP. 2014; Zimmermann et al. 2009). Their analysis shows that in most cases, government capacity to identify quick wins, and design and implement appropriate agricultural policies, was limited.

Effective policy development has to reflect the realities and diversity of rural livelihoods, especially those of farmers (Vorley 2002). The lack of proper scrutiny and understanding of local context can limit the impact of government policy on rural farmers. Evans1995) notes that successful states strive to attain coherent internal organization while maintaining close links to society. It is therefore important to build state capacity in policy design and implementation to avoid failures (Fennell 2009). There is a recognition that some of this capacity building may best be done at devolved local levels. Branch and Mampilly (2005) point out that local government is key, and decentralising decision-making to the 'most local authorities' is important for resource allocation at a local level. The objective is to ensure that this is where decisions of who gets included and 'who is excluded' are made.[27] The CAADP process recognises the importance of involving all levels of government and local communities in accelerating agricultural transformation.

---

[26] See policies for agricultural development in Rwanda in chapter 2 of this thesis.

[27] Processes of decentralization can be problematic (see for example Kasim and Agbola 2017) and this study does not address all of those issues. However, the notions of local control and local responsibility have been important in Rwanda's policy deliberation throughout this study (see for example MINALOC 2001, 2006, and more recently RGB 2018).

Some commentators doubt whether small-scale farming has the traction to deliver the required agricultural transformation. The fact that Africa is dominated by small scale farmers who lack the capacity to adopt new productivity technologies raises concerns about the future trajectory of agriculture (Gollin 2014). Given that generating agricultural growth through smallholder farmers is complex and costly, Collier and Dercon (2014) suggest a large-scale farmer-led approach. With improvements in global food chains and the possibility of exporting and importing food, there is a belief that countries can leapfrog agricultural development and focus on other sectors for economic development (Hazell and Xinshen Diao, 2005, Timmer 2005).

Despite such skepticism, reports show smallholder-led agricultural development in Africa is beginning to yield good results. Countries that have paid attention to agriculture are also among the fastest growing economies in Africa. A 2014 review showed that countries like Ethiopia, Burkina Faso, Ghana, Nigeria, Rwanda, Sierra Leone, and Tanzania managed to generate agricultural growth above the continental average of 3.8% (Pinto et al. 2014). Of these, Ethiopia, Ghana, and Rwanda generated growth primarily driven by yield increases in staple food. What is common among these countries is that they have strong and commitment leadership with each having a critical moment where smallholder agricultural development made sense to them. Having seen the modest gains made by these early adopter countries, more African countries are now following. During the 2014 Malabo Declaration, African leaders unanimously agreed to accelerate agricultural transformation and reaffirmed their commitment to the Maputo declaration. However, as shown in the next sections, the resulting policy approaches have been met with critical reactions.

3.3.1 Questions about the approach: Mixed responses to Rwanda's agricultural development processes

During the policy reforms of 2000 in Rwanda, it became apparent to policy makers that, in order to reduce poverty and avoid land-based conflict for a growing population (including waves of people moving or returning following great civil unrest and upheavals throughout the 20th Century), it was necessary to address the issue of land tenure security and low productivity (Golooba-Mutebi 2014; GoR 2000). Only if people had clarity about the extent of their land and the confidence of being able to defend their ownership against competing claims, would they feel sufficiently settled to focus on farming and farm improvement. As a result of this decision the Rwandan government, in consultation with different players, implemented a number of policies to improve both land productivity and tenure security.[28] While comparing the political economy of East African countries in 2014, Booth et al showed that the robust policies and strategies for agricultural transformation in Rwanda made the country an outlier in terms of positive agricultural growth amongst smallholder farmers (Booth et al. 2014).

In their analysis of Rwanda's political approaches, Booth and Golooba-Mutebi (2012) attribute the country's economic success to the unique policies and political institutions that differ from those in other countries in the regions. They show that contrary to many African countries, one of the distinct features of the politically-inspired economic path is that Rwanda has actively sought to eliminate elite capture and corruption as far as possible (Booth and Golooba-Mutebi 2012).

In another study investigating how Rwanda managed to achieve the Millennium Development Goals for Health, Abbot et al. state that perhaps the strongest part of the Rwandan initiatives has been the way in which reforms have been embedded in the community, with a fair measure of devolved decision-making and local responsibility for performance (Abbot et al. 2016 page 10). They highlight that the Rwandan culture provided a strong background for working together in the attainment of a joint goal, with local

[28] See chapter 2 section 2, 3 and 4

action following the lines of national plans and conceptions. However, this does not mean that the policy implementation processes are straightforward.

As shown in the agricultural sector, policy implementation is an intricate process. For instance, a survey of 742 households, conducted in 2011, showed that when the Land Use Consolidation Program (LUC)[29] was introduced in 2007, 45% of the respondents resisted the program and declined to join it (Nyamulinda et al. 2014). At the time, not all farmers were convinced that the requirement to work more closely with their neighbours would not have a negative impact on their own land security. However, after 5 years, about 40% of farmers in the study were actively participating, and of these, 90% were satisfied with being part of the LUC and 66% had increased yields (Nyamulinda et al. 2014).

Other studies confirm that farmers participating in the Crop Intensification Program have experienced increased production and productivity of food crops (Nilsson 2018; Murindahabi 2018; Golooba-Mutebi 2014). In their article: 'Achieving Agricultural Transformation: Rwanda Leads the Way' (World Bank 2015) the World Bank expresses positive views about the policies. While many praise Rwanda for the inspiring achievement, there are some who criticise the approaches that were used to generate this agricultural growth amongst smallholder farmers.

In a string of puplications, Ansoms (2009; 2013); Pritchard (2013); Huggins (2009; 2012; 2017) and Dawson and Sikor (2016) not only criticise Rwanda's agricultural policies, they also condemn the implementation approaches used and contest the reported positive impact of the policies.

Firstly, within their critcism of the policies themselves, this group of authors allege that no debate took place within Rwanda either during the development of the policies or around their ongoing implementation. They assume that

[29] The land use consolidation program is discussed in chapter 2 section 3.1

since policy processes are spearheaded by government agencies, there is a lack of local partcipation and therefore the resulting policies have not taken into account the needs of rural communities. This criticism is at odds with the stated policy aims of the Rwandan government whose interlinked structures and systems aim to generate and assess policy ideas from many sources.[30]

Most notably Rwanda's efforts to promote inclusiveness and accountability are demonstrated through an array of institutions, which are Rwanda's own 'home grown solutions' and have been developed from their culture and local innovation. These include umuganda (community work), National Dialogue Council, Rwanda Governance Board (RGB) and the more recent Rwanda Community Score Cards and 'Isibo' (a small unit of community organisation). Every village is made of at least 3 Amasibo (Isibo in plural), which are each made up of 15 to 20 households. These interlocking systems of organisation include citizen assemblies ('inteko') at the grassroots level, 'Joint Action Forums' (JAF) at the district level and then 'Sector Working Groups' within MINAGRI, at the Ministry level. These institutions are commissioned by the government to bring policy makers and citizens closer together, to engage in conversations that generate policies. They also seek to create an effective mechanism for feedback on those policies from the local communities, as the adoption and implementation of the policies unfold. Thus the assertion of 'no policy discussion' cannot be assumed to be correct; no data are offered to support this idea, so the criticism must be treated as a simple assertion or opinion – not as an established finding.

If their publications are read as a unified body of work, this critical group of authors highlight criticisms of cooperative policy, land policy and the CIP policy. Concerning CIP, the authors all share concerns that an emphasis on agricultural intensification and modernization indicates a bias towards larger farmers, whose farming structure allows for investment in more highly

---

[30] See the detailed discussion on policy development from the policy makers perspective in chapter 5 of this thesis

productive farming systems. They claim that the policy objective of shifting from subsistence and multi-cropping systems to specialisation and commercialisation will be detrimental to poorer smallholder farmers. The concern here is that government policy, particularly CIP, is not 'pro-poor'. However, analysis contained in reports evaluating that question show that the inverse is true, and that these policies are generating positive outcomes on small-scale food producers - and that the smallholder agricultural sector has had significant impact on poverty reduction (see, for example, GoR 2002; World Bank 2014).

The critical authors do not believe that monocropping and land use consolidation (LUC) are feasible for Rwanda. They question the idea of prioritising six types of crops, with concerns that such a policy will reduce crop diversity and compromise food security. In particular, Dawson, et al. (2016, page 215) and Huggins (2017, page 17), indicate that government policy has disrupted the traditional subsistance practices that have been long-established and found to be inventive and effective (thereby echoing very exactly the 'romantic ideal' against which Thurlow (2013) makes his warning)[31]. Neither Dawson nor Huggins acknowledge the fact that before the 2009 agricultural reforms, when farmers by default followed their traditional practices, farmers failed to keep up with their household food requirements, and the contry as a whole failed to keep pace with the needs of the increasing population; most actually lived in deep poverty (GoR 2000; Campbell et al 1993).

Regarding land-use consolidation, the same authors raise an alarm, saying that government policy was likely to create conditions leading to elite-capture, and loss of land for particularly poor farmers (Huggins 2014 page 380, Pritchard 2013). Pritchard expresses concern that tenure security through the land registration system is undermined by the supposed mandatory crop specialisation promoted by CIP, since there was fear that the government

---

[31] As set out in full at page 79, above

could confiscate farmers' land for alleged lack of compliance with that policy (Pritchard 2013 page 190).

The data within both authors' work does not demonstrate that such elite capture or loss of land actually took place, suggesting that there is no theoretical basis for these fears, nor any practical foundation. In fact, as shown within Chapter 2[32], the government's joint policies of land registration and LUC were able to complement one another to address this very issue. Policies aimed to increase farmers' sense of security of land tenure, to promote their investment of labour and inputs in land, and to encourage co-operative working within communities (without undermining individual ownership in parcels of land brought into LUC programmes).

Huggins suspects that the government's emphasis on cooperatives and LUC is not focused on helping farmers but rather aims to facilitate policy implementation and enable state control over crop production (see for example Huggins (2014, page 324); Huggins, (2017)). He argues that cooperatives are inherently likely to lead to elite capture and exclude poor farmers. Huggins concludes that these institutions will restrict the ability of farmers to make their own decisions, whether in relation to crop choices, investment in inputs or marketing (2014, page 380). Surprisingly, given the forcefulness of the conclusions, Huggins does not appear to have taken into account the potential of such policies to enable even the poorest people to pool their resources, work with and learn from one another, and thereby actually improve their own skills, enhance their sense of being in control, and even the possibility of reducing hunger and improving the lives of the whole community.

This group of writers' criticisms continue by focussing on the perceived shortfalls of the methods used to implement Rwanda's policies. Pritchard argues that the 'simultaneous and aggressive' implementation of mandatory

---

[32] See Chapter 2 Section 3

registration and land consolidation undermines land tenure and food security for farmers. This is echoed by Huggins (2009) and Pritchard (2013) who make very serious assertions that the government uses coercive measures during implementation of their agricultural policies. They raise concerns about farmers being forced to grow the crops that the government has prioritised, and also to join cooperatives. However, since neither author gives any indication of the proportion of surveyed farmers that had actually engaged with the CIP policy (whether coerced into participation, or otherwise), it is difficult to gauge the magnitude of the problem. Whilst it is possible that some farmers could have been forced to engage in government programs by local leaders keen to achieve targets, it is also likely that since the fieldwork for both the studies was conducted in 2009 when policies were still relatively new, their research could have been influenced by farmers' initial resistance to change (Juma 2016) which has reduced over time as the policies have proven to be effective. Certainly, the crop-growing data for 2009 (and indeed in later years) does not support their assertion. The diversity of crops grown in Rwanda remains substantially unchanged; farmers grow more than 10 types of crops (National Institute of Statistics 2017 page 19. This factual picture is entirely at odds with the unsupported assertions made by this group of authors.

The final component of the criticisms levied at Rwanda's polices is that they have left people worse off. This is also implied by both Okito (2019) and Dawson (2016). Clearly this is a very serious assertion, and one that goes to the very heart of what the policies were said to set out to achieve. These two authors make this assertion or implication, but each with a slightly different focus. Okito questions the accuracy of the poverty data produced by Rwanda's government, although it is regarded as sound by the World Bank, and other credible development partners. The World Bank explicitly entered into this debate – and published a working paper specifically to refute allegations that poverty data in Rwanda was inaccurate (Fatima and Yoshida, 2018). Dawson, meanwhile, focuses on the seemingly detrimental impact of the policies on the farmers themselves. Dawson's approach is examined in more detail below.

On the face of it, the work of Dawson, et al (2017) seems to use a more recent study (with fieldwork carried out in 2011/2012) to consolidate the arguments of Ansom, Pritchard and Huggin. The Dawson, et al. (2016) paper argues that although agricultural policies have raised yields, making them appear successful, the policies are exacerbating landlessness and inequality for poorer rural inhabitants. This very serious set of insights is examined in some detail here. However, Dawson's methodology is problematic in a number of respects, making a detailed analysis challenging, and somewhat undermining the force of the arguments made. Certainly, the arguments do not appear to flow naturally from the data, and should therefore be treated with circumspection.

The paper is built on a field study of rural farmers in the West of Rwanda, carried out in 2011/2012. 164 people were interviewed, and in order to analyse the results of the study they were broken down into four categories:

1. 'Landless labourers' (56 people – average land 0.13 ha[33]);
2. 'Resource poor' (63 people – average land size 0.56ha[34]);
3. 'Relatively wealthy, diversified farmers' (40 people – average land 2.00ha);
4. 'Relatively wealthy professionals without livestock' (5 people – average land 2.25ha, plus, presumably, professional income).

Within each of these four categories, Dawson then attempts to affix socio-ethnic labels within 3 further categories: long-term residents, returnees from DRC and Twa. This is explored in more detail below.

By far the poorest group considered by Dawson et al, of course, are the landless. However, it seems illogical to critique a CIP, land-ownership, land-use basket of policies on whether it delivers benefits to those who do not own

[33] This is a very small area indeed – and treated by the Dawson et al paper as, in effect, no land at all.
[34] This is close to the mean for land ownership in Rwanda, but is a small area on which to try to support a family or household in Rwanda's agro-ecological conditions.

land. Seventy-five percent of this group suffers foodless days at least once a month – and clearly efforts to support them are crucial. But they are unlikely to be via this particular set of policies.

The 'resource poor workers', the farmers with small farms, also experience foodless days, but fortunately not at the same level as the landless labourers. Twenty-five percent go without food once a month, bringing them closer to the level of the so-called 'relatively wealthy'. These farmers are clearly an intended target of these policies, and their experience is important in evaluating the policy success.

It is worth noting that the 'relatively wealthy, diversified farmers' is the group that Dawson et al say receive the greatest benefit from government policies, and that this, characterised as elite capture, is a cornerstone of their criticisms. It implies that this group is wealthy enough not to need further benefit from policies that are supposed to be pro-poor. But this is a flimsy argument. Even if it is the case that these are the main beneficiaries of the policies under discussion, this should not be an inherent ground for criticism. Perhaps the problem is in the label. These farmers are amongst those so vividly described by Thurlow[35] – enduring the hardships described for all the reasons Thurlow mentions. On the data of Dawson et al themselves, 13% of these households go entirely without food for at least one day a month throughout the year. This implies chronic levels of food shortage and meal-skipping amongst at least a significant minority of the group, and possibly more. Perhaps the group would be better labelled as 'slightly less poor', to avoid the misconception that these are thriving well-to-do farmers.

This detailed review of the categories highlights the importance of rigour and neutrality when criticising policies. The definition of 'wealthy' is a surprising one in relation to hungry farmers, and suggests that the authors are using their framing to make an emotive point that is not really supported by the data. Similarly, the decision to criticise a land-use, land-ownership, CIP

---

[35] See page 79 above.

basket of policies for the failure to alleviate the hardships of those who do not own land is a curious one, and undermines the sense that the critique and intention of the paper is impartial.

Dawson et al make strong statements about many participants in the study being obliged to grow maize despite their perception that alternative crops (such as sweet potato, banana, or taro) would be more productive and leave them less vulnerable to food shortages (page 212). While the authors emphasize that many households were compelled to substantially change their practices and adopt CIP prioritised crops, they provide no details at all about the number of farmers amongst those interviewed who actually grew these various crops in the past, or had changed their cropping habits now, and were thus directly affected in this way. Without that information these assertions appear to be anecdotal at best, though they are important in the arguments and conclusions drawn. In reality, the assertion about crop-switching is inconsistent with the data produced by the National Institute of Statistics of Rwanda (NISR), showing that the profile of crops being grown in Rwanda remains wide (National Institute of Statistics of Rwanda 2017, page 19). It is extremely unlikely that any community visited by Dawson et al for their research would be growing only a single crop. Of course, without any data at all on this point in the paper, it is hard to comment on the detail, but if this was the case, then it suggests that the community was an exception and not a fair representation of the whole of Rwanda, from which it would be possible to generalise about the impact of a particular policy.

The Dawson et al study shows that 31% of farmers interviewed had adopted the use of chemical fertilizers but this varied according to the Dawson et al categories, as shown in Table 3.1

Table 3.1: Showing the Dawson et al (2016) reported take up of chemical fertiliser use across the Dawson et al socio-economic categories of farmers surveyed in Western Rwanda.

Dawson et al category	% Uptake of fertiliser use	No Uptake of fertiliser use
Landless labourers (average 0.13 ha)	16%	8 adopters
Resource poor workers (Average 0.56 ha)	30%	18 adopters
Relatively wealthy, diversified farmers (Average 2 ha)	53%	21 adopters
Relatively wealthy professionals without livestock (Average 2.25 ha)	80%	4 adopters

The Dawson et al data demonstrate that, in numerical terms, the highest uptake of chemical fertilizers comes from within the two middle groups: the 'resource poor workers' and the 'relatively wealthy diversified farmers' categories, which are the key target groups for this policy. It is entirely to be expected that the adoption of fertiliser use would be limited among the landless (or very near-landless). The very small group in numerical terms of the 'relatively wealthy professionals without livestock' cannot be said to skew the distribution of fertilisers in any material way.

The study is silent on the actual impact of the adopting the use of fertilizers. It is also not articulated clearly within the study if the reference to use of fertilisers by the farmers is linked to CIP policies or to tea-growing (mentioned as relevant to some of the farmers in the study, but not broken down in relation to fertiliser use). Tea-growing is an entirely separate industry that is private-sector led. If these two have been conflated, it casts doubt on the merit of the data as a whole, and if they have not it is impossible to discern from the paper how the practices of the tea-industry farmers have been dealt with.

Dawson et al's study shows that a significant minority of the 'landless laborers' (36%) say they became landless within the preceding decade. The paper flags many possible causes for this such as the conversion of cropland to tea, CIP policies, afforestation, policies promoting modernization of rural communities, and poverty in general. The paper does not explicitly label these as causes for landlessness, but nor does it show any data about the causes given by the 'landless labourers' who have lost their former land-holdings. This, again, means that the Dawson et al conclusions are flawed. They do not explore other possible causes or explanations, and instead appear to attribute the entire issue to CIP or LUC or land titling (but not any one of these policies in particular).

Perhaps the most problematic aspect of Dawson et al's decision to include ethnic categories within their study is that it shows an insensitivity for the approach to ethnicity adopted in Rwanda, by Rwandans themselves, following the genocide. The idea that every citizen is now 'Rwandan' has been adopted as a way of facilitating reconciliation and recovery. Whilst a full explanation of this falls far outside the scope of this research, it is important to mention that Rwandans do self-identify as Tutsi, Hutu or Twa today. It is difficult to understand the justification for so casual an infringement of these principles. If there is an 'ethnicity' story to tell, it should be approached with extreme care, rigour and circumspection, as a simple courtesy to Rwandans of all histories, as their country rebuilds. These attributes are not shown in the Dawson et al study, to the detriment of the quality of the work and the sensitivity to Rwandan etiquette.

Even as they imply that their study has wide application for arrangements in Rwanda, they fail to point out that the three districts, Rutsiro, Nyamagabe and Nyamasheke, selected for their study are actually amongst the most food insecure districts in the whole of Rwanda, and two of them are also amongst the very poorest: out of a total of 30 districts in Rwanda, these three are ranked 30, 29 and 25 respectively for food insecurity (WFP 2015, page 35);

Nyamasheke is actually the poorest district of all in Rwanda, ranking 30 out of 30 (both in 2011 and 2013/14), whilst Rutsiro is ranked 26th or 27th according to the year (National Institute of Statistics of Rwanda 2014, page 39). Only Nyamagabe is a mid-table district on poverty, sitting at 14 or 16 out of 30 districts (in spite of its very severe food insecurity). It is therefore methodologically unsound to draw conclusions about the whole of Rwanda based on sample in this particular study.

In all of these ways, therefore, the Dawson et al (2016) paper has made claims that exceed the limited scope of a study that conducted fieldwork in three districts, and interviewed 165 people (page 209). It seeks to generalize its conclusions from the areas sampled to the whole of Rwanda (and indeed the whole of Africa (as evidenced by the title of the article: Green Revolution in Sub-Saharan Africa: Implications of Imposed Innovation for the Wellbeing of Rural Smallholder). It is for all of these reasons that the Dawson paper has to be viewed with great caution.

My research sheds more light on most of the criticisms made or hinted at in the Dawson et al paper, where they focus on agricultural development. Through interviews of a wide range of key stakeholders the research aims to understand the complex systems through which Agricultural development in Rwanda has emerged. Smallholder agricultural development requires institutional arrangements at the national and grassroots level that support and enable access to information, technology, finance and markets.

3.4 Understanding Institutional Arrangements that Support Smallholder farmers

Institutions offer a compelling lens through which agricultural development can be analysed. Acemoglu and Robinson underscore institutions as the ultimate drivers of the economic development process (Acemoglu and Robinson 2008). Agricultural transformation, is underpinned by a set of institutional changes that facilitate access to services, inputs and markets for farmers (Bonnen 1998). This section is organised in 5 sub sections that analyse the literature on institutions that support farmers' access to information, inputs, markets, land, finance, and collective action to understand how they impact agriculture.

3.4.1 Conduits of agricultural information in rural communities

Rural farmers are often oblivious to what new technologies exist. How do individual farmers learn about new technologies? How do they decide to adopt the use of new technology? These have been questions of considerable interest among scholars and policymakers (see for example Rogers 1983; Doss 2003; Mwangi and Kariuki 2015).

The battles over new technology are especially prominent in agriculture (Juma 2016). Changes in agricultural technologies do not only have economic implications, but they transform how people produce food, bringing in new cultural practices. Technology adopters are those able to cope with the resistance, difficulties, and anxieties associated with trying new ideas. As the stock of information increases and uncertainties reduce, technology adoption among farmers is likely to increase (Feder, Just, and Zilberman 1985).

There are various channels of information about new technologies (Rogers 1983). Innovation and agricultural change are driven by the interaction of ideas and people working together to achieve a common goal (Hall 2006). The importance of farmers' networks in disseminating information, and the role of agronomists as change agents, cannot be overstated (Nsanzabaganwa 2012).

In agriculture, extension services are an important means of gaining information and knowledge about new agricultural technologies. Extension agents take the role of disseminating technical information through various means, including farmer visits, community meetings, training, and demonstration plots. As such, they provide a two-way flow of information between researchers and farmers (Onazi 1982). Traditionally, rural farmers in Africa accessed extension services mainly through government programs (Ferris et al. 2014). Complementing formal extension services with volunteer farmer-based approaches have been found cost-effective in spreading new agricultural technologies to many farmers (Kiptot and Franzel 2015, Lukuyu et al. 2012).

Farmer networks play a significant role in influencing adoption decisions, especially during the initial stages of technology dissemination (Ramirez 2013, Matuschke and Qaim, 2009). Day to day interactions between individuals and engagement with various groups can be effective in transmitting information and knowledge about the new technology. This is partly because word of mouth and testimonies from community members may be more trusted than the extension agents, who may be considered outsiders (Ramirez 2013). However, in some cases information flows through a sparse network within and between villages can be limited (Conley and Udry 2001). The formal groups have been found effective in dispersing information to members.

Membership to farmers' organisation facilitates access to information, and technical advice through extension agents (Abebaw and Haile 2013). However, in some cases, extension services alone may not effectively generate the required agricultural transformation (Udry 2019). This is because farmers' decision to use a technology does not only depend on access to information but other factors such as access to the right technologies and markets.

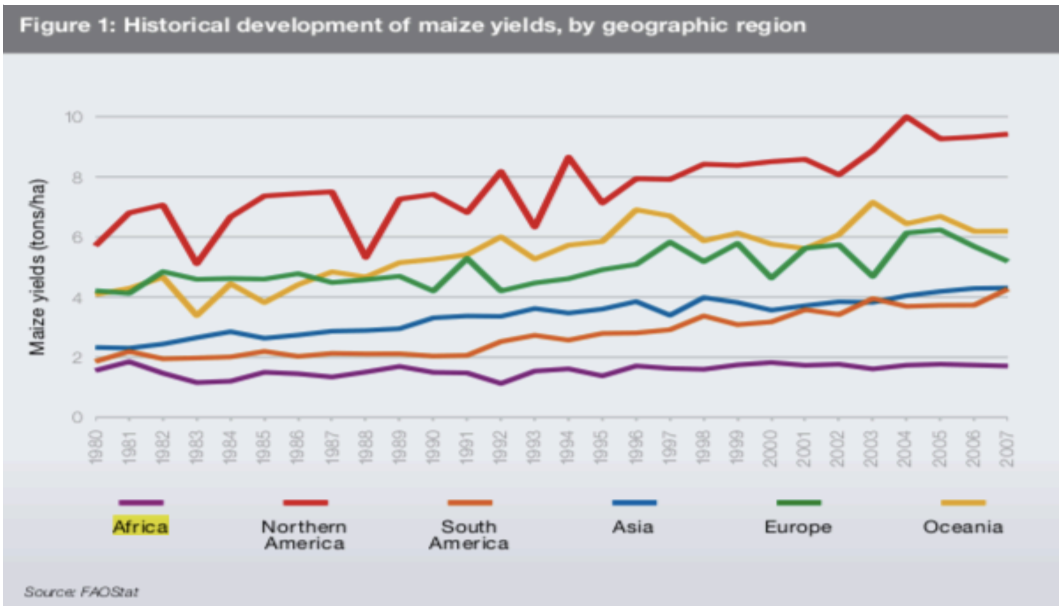
Individual decisions at the farm level are embedded in the institutional, social, and economic structures at the national level that influences farmers' technology choices. Therefore, by introducing new technologies and new channels of communication, the state may affect the speed of innovation at the farm level (Timmer 2005). The next section explores the literature on agricultural innovation in Africa to identify factors that constrain supply and demand.

3.4.2 Factors that affect technology dissemination in rural areas

This section investigates some of the causes of low technology supply and uptake in African countries. While farmers in Africa have experienced profound changes in farming systems over time, particularly as new crops were introduced, recent efforts to increase land productivity have been unfruitful (Carr 2001).

One of the factors limiting agricultural productivity in Africa is the lack of access to productive technologies by rural smallholder farmers (CTA 2014, FAO 2009, Ghatak and Ingersent 1984). Despite some success stories, progress in improving agriculture is slow and crop yields are among the lowest in the world (FAO 2009).

Figure 3.1: Maize yields by geographic regions



Source FAO (2009)

Figure 3.1 shows a big yield gap in maize production between African and other regions. In most African countries, farmers are trapped in traditional systems that have limited potential to generate significant increases in agricultural productivity (FARA 2014). Yet the new challenges of reduction in land size and quality, increasing crop diseases and pests, and climate change, make the need for more productive technologies even greater today.

The heterogeneity of the African continent makes technology spillover difficult (HarvestChoice 2010, FARA 2014). Africa has diverse ecological ecosystems, as reflected in the various farming systems and the consumption patterns of different regions of the continent. Thus, improvement in farming systems needs an array of technologies that respond to various agro-ecological and social conditions. Scientific research must play a key role in determining the availability and adequacy of agriculture technologies.

The number of seeds, particularly maize varieties, capable of increasing yield in Africa is growing (Mabaya (2016). Yet, weak institutional arrangements at the local and national level constrain their accessibility for rural farmers. In most cases, good quality seed is out of reach for rural farmers (Gaffney et al. 2016, Louwaars, de Boef, and Edeme 2013, CTA 2014). In central and East Africa, on average, only 20% of improved seed, mainly maize and rice, is supplied through formal channels (CTA 2014). Part of the problem is that farmers live in remote areas not reached by official seed retailers because of poor infrastructure (Lanteri and Quagliotti 1997). Consequently, the majority of farmers depend on seeds from the informal system where planting material is saved from previous harvests.

Although informal seed systems are often well adapted to local conditions, these systems have been deemed inefficient, involving outdated seed unable to stimulate the yield increases required for agricultural transformation (Gaffney et al. 2016). That is why agricultural policy tends to lean towards formal seed systems, encouraging a shift from informal to hybrid-based commercial seed systems[36] (Louwaars, de Boef, and Edeme 2013). Equally, it is essential to keep in mind that the effectiveness of any seed program will depend on the fertility condition of the soil (Larson and Frisvold 1996).

Soil degradation and infertility have become a pressing issue in Africa (Jayne, Chamberlin, and Headey, 2014). Crawford, Jayne, and Kelly (2006) show that by 2000, about 65% of African agricultural land was already degraded. Land degradation is particularly severe on steep slopes prone to soil erosion. In these areas, technologies – including building infiltration ditches, agroforestry trees, live hedges, and terraces can be used to combat soil erosion (Kagabo et al. 2013). To address the fertility issue, the use of organic and organic fertilizers has been found to increase soil nutrients and yield without depleting the soil. While most African farmers use organic fertilizers like manure and ash to gradually increase yield, chemical fertilizers lead to higher crop yields (Carr 1989, Roberts 1999).

Despite this benefit, the average usage of chemical fertilizers in Sub Saharan Africa has remained below 10kg per hectare, the lowest in the world (Morris et al. 2007, NEPAD 2011). Larson and Frisvold (1996) recommend that to significantly increase yield, fertilizer usage has to rise from the current 10kg/ha to about 50kg/ha. They argue that this level of fertilizer use would boost crop yield without compromising the environment. The fertilizer target was adopted during the 2006 Fertilizer Summit when countries committed to increasing fertilizers use to 50kg per hectare by 2025. However, progress towards this target has been slow in most countries with fertilizer usage still below 10kg per hectare in 2011 (NEPAD 2011).

The low fertilizer usage in Africa can be ascribed to factors of demand and supply (Poulton, Kydd, and Dorward 2006, Morris et al. 2007). On the demand

---

[36] Hybrid seeds are created by natural cross-breeding varieties. The breeding process results in a seed that carries one or more favorable traits.

side, farmers' incentive to use fertilizers is undermined by the variability of crop yields, prices, and the high cost of fertilizers. Banful (2010) shows that 50% of market fertilizer prices across Africa can be attributed to transaction costs, in particular, transport costs. This cost raises price rates, placing a significant burden on poor farmers with limited resources. Moreover, uncertain weather conditions pose high risks to returns on fertilizer investment.

Crop production in Africa is mainly rain-fed, with only 6% of the total cultivated land irrigated (You et al. 2011), and scientists say that rain patterns will continue to become more unreliable as a result of climate change (Trenberth 2011). In drought-prone areas or places where rain may be inadequate, the scope of profitability for fertilizer users might be limited (Carr 1998). Therefore, incentives, including subsidies, may be needed to make agricultural inputs affordable by smallholder farmers (Dorward 2009).

A study in Malawi, Zambia, Ghana, and Tanzania found that although subsidy programs lead to greater use of inputs, there are supply issues at the national and regional levels (Baltzer et al. 2011). Input delivery systems are often costly, inefficient, and unequal. State-managed networks and corporations are expensive and difficult to monitor, and in many cases, input deliveries to farmers are late. In a bid to improve the efficiency and effectiveness of subsidy programs, ‘smart subsidies’, that target farmers most constrained by market failures, are recommended (Dorward 2009).

Technology-led agricultural transformation is complex, and there are socioeconomic, environmental, and institutional factors that constrain the supply and demand of inputs. These constraints make it difficult for countries to successfully develop systems that supply timely inputs to rural farmers. Chapter 6 of this thesis discusses the farmers' interface with new inputs. One way of encouraging the use of capital-intensive inputs is to facilitate farmers’ access to profitable markets. The next section discusses factors that influence market participation.

3.4.3 Factors that affect agricultural commercialisation

Agricultural transformation calls for increased investments that require extra effort and a cash outlay from farmers. Farmers are likely to invest in agriculture and increased output if there have clear prospect of the benefits (Abbott 1962). This section explores the literature on the factors that influence agricultural commercialisation among farmers.

Several studies have shown that the lack of connectivity to lucrative markets for rural farmers has stalled agricultural transformation in Africa (see for example, Torero 2014; Gabre-Madhin 2009;). In East and Southern Africa, most smallholder staple grain producers do not participate in markets on any significant scale (Barrett 2008). Commercialisation at the farm level is often constrained by diverse social-economic conditions associated with operating in the remote areas where the majority of farmers are based (Torero 2014).

In most African countries, rural connectivity and infrastructure have lagged. A study in 2008 revealed that only one-third of Africans living in rural areas are within 2 km of a seasoned road, compared to two-thirds of the population in other countries (Foster 2008). Also, rural roads are often in poor condition, making traveling to remote areas difficult (Suruma 2014). Taking the experience of the Green Revolution in Asia, the earlier investment in irrigation and roads were necessary for success (Johnson, Hazell, and Gulati 2003). Investment in more extensive road networks contributed to lowering transaction costs and greater market integration for farmers.

On the contrary, Sebastian reported that about 34% of the rural population in Africa live more than 5 hours away from a market town of 5000 people (Sebastian 2008). Traveling such distances has an essential bearing on agricultural activity. Agricultural productivity and commercialisation in isolated areas are limited by traders' tendency to avoid remote areas due to high transport costs and low agricultural productivity (Barrett 2008). Dorosh et al. 2010 find that agricultural production and farmers' proximity to a road or market is highly correlated.

In market constrained areas, farmers have no incentive to produce more, particularly if storage spaces are limited (Platteau 1996). Typically, household storage space is small, reserved for seed and household food storage. The limited physical infrastructure and the remoteness of farmers have an impact on transaction costs, the flow of commercial information, the incentive to increase crop yield, and smallholder participation in markets (Poole 2017).

Juma (2015) argued that investment in telecom infrastructure is likely to initiate faster agricultural growth. Mobile phone technology is already making communication easier and reducing transition costs for farmers (Mittal 2016). The improved access to information on best practices, weather, markets, and prices facilitates fast positive changes among farmers. Despite the benefits, the proportion of rural dwellers with a mobile phone is still low (Rhealt and Mcarthy 2015). Conversely, as market demands become more complex, demanding close interaction among crop buyers and sellers, participation in these markets for smallholder farmers is increasingly challenging.

Agricultural markets have become more demanding in terms of the quality of the products. For instance, high levels of Aflatoxins[37] causing problems of grain quality for buyers and farmers in East Africa (Udomkun et al. 2018, Walker, Coulter, and Hodges 2007). Today, farmers have to acquire appropriate equipment and infrastructure to ensure that grain has the right measure of humidity before the sale. Urbanization and supermarkets have led to increased demand for products that are standardized in terms of variety, quality, size, and taste (Reardon, Timmer, and Berdegué 2008). Because of

[37] Aflatoxin is a poisonous carcinogen produced by a specific mould in grain and vegetables.

these market standards, traders tend to prefer working with larger suppliers who can guarantee the right quality and quantity to meet the required specifications (Poole 2017). Cooperation through producer organizations provides smallholder farmers access to more lucrative markets.

In the African culture, cooperation is locally rooted, confined within community boundaries and social classes (ILO 2014). Community members form small self-help groups that are based on trust and social cohesion. These informal groups, which often coexist with the formal cooperatives, can be important drivers of agriculture. By forming groups, farmers hope to pool together resources, support each other with various challenges, and access better markets (Bolton 2019). Despite the known benefit of linking farmers to markets, only 7% of the African population belongs to and form of cooperative (ILO 2014). As has been reported, women's participation in cooperatives is often constrained by a host of cultural, social, and economic factors, including access to financial assets, time, finances, and information (Kaaria et al. 2016).

Market participation by smallholder farmers is influenced by high transaction costs originating from many factors, including scarcity of infrastructure – especially roads and markets – poor access to information, lack of organization among farmers, low use of technology and output, limited capacity and knowledge to deal with the changing market demands. Addressing these issues has been found to increase technology adoption and market participation. As farmers engage in more productive technologies, increase yield, and participate in markets, access to finance to support their agribusiness activities becomes essential.

3.4.4 Sources of finance for rural communities

Since farmers have to invest in different aspects of farming to increase output sustainably, the scope of agricultural transformation hinges on the ability to access finances. As discussed in previous sections of this chapter, farmers need money to purchase costly inputs. This section discusses the literature that explores the different ways in which rural farmers can access finances.

The literature shows that In Asia, farmers' ability to access agricultural credit flued the Green Revolution (Binswanger, Khandker, and Rosenzweig 1993). Bank credit facilitated fertilizer uptake, investment in mechanization, and irrigation for farmers. In African countries, most rural dwellers have limited access to formal finance (Reuben et al. 2015). Studies show that no more than 20% of seasonal agricultural credit demand is satisfied (Jessop Reuben et al. 2015, Munyambonera et al. 2012). Although agricultural credit for rural farmers is supplied through both informal and formal institutions, farmers rely more on the later (Meyer 2011, Rahman and Smolak 2014).

Since groups have small operations, financial transactions involve limited amounts of cash, and require limited skills, meaning there are low barriers to entry (Flynn and Sumberg 2018). As a result, small groups are flexible and able to attract different types of people and respond to various financial needs among communities (Bukenya and Magambo 2016). However, although small groups are beneficial, in cases where investment is modest, their transformative potential is restricted (Flynn and Sumberg 2018). Munyambonera et al. (2012) highlight that because of limited sources of finance, informal institutions often struggle to meet all of the farmers' financial demands.

Despite the limitations of small groups, they are the first step towards financial inclusion, encouraging learning, and building social capital that enables links to other types of financing. Small saving groups also attract greater participation and access to finance for women (Karlan et al. 2017). In fact, in some cases, informal institutions act as conduits to more formal financing that expands the range of products available to farmers (Rahman and Smolak 2014).

While formal financial institutions offer extensive services, they are more reluctant to operate in remote areas. Formal institutions, especially banks, tend to avoid remote areas because of the high transaction costs associated with rural micro-lending. Yet operations of the more rural-based financial institutions like the Micro Finance Institutions (MFIs) and Saving and Credit Cooperatives (SACCOs) are often smaller compared to banks (Reuben et al. 2015), resulting in more significant financial constraints in rural agricultural areas. SACCOs tend to be trusted organizations since they are rural-based and enable financial inclusion to members (Lichtenstein 2017). In some cases, farming cooperatives provide farmers with input credit since they may also be the input distributors (Doss et al. 2003).

Generally, agriculture tends to be unappealing to financial institutions because of the perceived risk associated with the farming sector (World Development Report 2008). Uncertainties in farming, including environmental factors like weather, diseases, and pests, as well as market and price volatility, label agriculture as a high-risk sector for formal financing. The apparent risks and the absence of agricultural insurance slow down the development of financial markets that could enable smallholder engagement in new high yielding technologies (Carter 2008). Moreover, considering that smallholders demand smaller amounts of inputs, and the use of hired labour is minimal, financial institutions tend to view these farmers as creditworthy (Meyer 2011).

On the demand side, the inability of formal institutions to design appropriate products and delivery systems tailored to agriculture discourages farmers, mainly smallholders, from engaging with formal financing (Bukenya and Magambo 2016). The process of applying for credit, with its requirement of collateral, repayment terms, and timing of loans from financial institutions, can be daunting for rural farmers. Firstly, farmers may be reluctant to use their limited and valuable resources as collateral (World Development Report 2008). Secondly, the inherent challenges in rural farming communities, including limited use of technologies, low agricultural productivity, low levels of saving, illiteracy and limited information, make farmers more likely to face difficulties in obtaining and paying off formal credit (Jessop et al. 2015).

This section has reviewed the literature on financial institutions used by the rural farming community. It highlights that in the absence of well-functioning formal commercial systems, rural farmers turn to informal institutions to sustain their economic activities. However, informal financial arrangements have been inadequate in advancing greater investment and enabling significant agricultural improvement for smallholder farmers. Access to finance can be improved through government policies that ensure law enforcement, conflict settlement, property rights, and land rights (Jessop et al. 2015). The next section investigates land systems in Africa and how land tenure security can be improved.

3.4.5 Land ownership in Africa and its effect on agriculture

Strengthening land rights has become a key priority in African countries (African Union, 2006). The Assessment done by the Africa union and other authors show that the historical and prevailing land tenure systems in Africa impend beneficial economic and agricultural change (African Union 2006; Ellis 2005). This section draws from different bodies of literature to explore ways in which land patterns and tenure systems affect agricultural development.

Arable land across Africa is dominated[38] by small-scale farmers operating on plots of less than 2ha (Conway 2014). Since the most common way of accessing land in most African countries is through inheritance, the land is continuously fragmented and passed down to different heirs. There are mixed

---

[38] Eighty percent of African agricultural land is under small-scale farming (Conway 2014).

views on the effect of land fragmentation on agricultural productivity. Some have argued that land fragmentation can have positive impacts on productivity, because it allows farmers to access diverse agro-climatic conditions, mitigating the risk of pests and disease (Blarel et al. 1992). In contrast, others show that land fragmentation is the critical limiting factor in agricultural production and that organising and operating on many scattered plots raises the cost of production (SWAI 2016). Farmers lose time traveling between plots scattered in different locations.

Successful agricultural transformation requires countries to address the issues of small and fragmented parcels of land to facilitate increased yield and encourage commercialisation (FAO 2003). One policy response to land fragmentation is land consolidation. Although land consolidation has been an effective response to land fragmentation in some countries (Nilsson 2018, Mukana 2009, Keeler and Skuras 1990), this approach is limited in Africa. There is a need to evaluate traditional land tenure systems to develop land reforms that fit the different African contexts in Africa (Asiama, Bennett, and Zevenbergen 2017).

The majority of land in Africa is own through statutory or customary land laws, with most farmers under traditional/customary systems. A study in 2000 showed that 90% of land in Africa was under customary land systems (Deininger 2004). Customary tenure systems offer considerable tenure security for local land users through internal arrangements that allow individual and communal land use. These systems also include conflict resolution mechanisms and land demarcation to minimize the threat of land loss and encroachment. Moreover, land scarcity due to population pressure has increased demand for land in many areas (Otsuka and Place 2014). However, in most cases, land rights under customary tenure regimes are weaker, particularly for women than men (Akinola 2018).

As highlighted by (Jayne et al. 2016), there are concerns that the increased land demand and possible elite capture will undermine customary tenure systems in Africa to the detriment of poor communities. For instance, in cases where there is no formal documentation of land ownership or possession, there is a likely risk of non-transparent transfers, which may result in land loss, discouraging participation in land markets (Deininger 2014). Even where reforms have occurred, Fennell (2009) points out the issue of incomplete documentation of land redistribution and titling, which makes conflict resolution complicated.

More secure and formal tenure systems are needed to encourage investment in land and increased productivity (Otsuka and Place (2014). Scholars have presented land registration and titling as a formal system that could safeguard land rights (see for example, De Soto 2000; and Feder 1988). They show that land registration is a mechanism through which people can achieve more secure land rights. For instance, as shown by Deininger et al. land registration and titling can prompt vibrant land markets, inspire the renting and transfer of land to the most productive users, hence enhancing agriculture (Deininger et al. 2008). Furthermore, titles enable long-term capital investment and facility owners to use the land as collateral to secure loans to finance their investments. Moronha (1985) states that tenure security provides an advantage when it comes to long-term investment in physical land improvement, like terracing. There is also evidence that land tenure security provides incentives for farmers to invest in productive technologies and improve land quality (Gao, Sun, and Huang 2017; Feder 1988). Despite the benefits, some say land titling is overrated and in most cases, unable to provide tenure security for the poor.

While land titling has increased land tenure security, especially for women in Senegal and South Africa, Payne finds no evidence that it increases the likelihood of farmers to access credit (Payne 2008). Poor households avoid using land as collateral for fear of losing their main property. Payne argues that whether communities benefit from land titling or not depends on historical context, income levels, and access to services. He concludes that in areas where there is no property threat, land titling is not considered important for agricultural improvement. As shown by these

Sitko, Chamberlin, and Hichaambwa (2014) reveal that in Zambia, where 90% of smallholder farmers depend on customary-owned land, registering and titling have not led to the expected improvements in tenure security and agricultural improvements. Firstly, land titling involves a bureaucratic and complex process with high transaction costs, making it difficult and expensive for rural farmers. Secondly, it seems to favour external investors and more prosperous farmers, excluding smallholder farmers. As shown by these studies formalising land ownership is complex to implement and, in most cases, does not resolve issues of tenure insecurity.

Irrespective of the pros and cons of the formal and informal systems, there is consensus on the need for secure land tenure systems to promote agriculture and economic development (Deininger 2014) WDR 2008 Lipton 2009). The provision of tenure is an institutional reform that significantly reduces the transactions costs associated with agriculture (North, 1990). Some African countries are turning to more formal land registration systems. For instance, Ethiopia and Rwanda, the leading countries in agricultural development on the continent, have undertaken massive land registration projects. In both countries, there has been a strong political will to secure land tenure security at a considerable cost (Deininger et al. 2008, Ngoga 2018). Chapter 2 of this thesis describes the process of land tenure reforms in Rwanda, and Chapter 7 shows their impact on farmers.

With increasing land scarcity in Africa, there is recognition of the need for institutions that safeguard land rights for the poor and support agricultural transformation. Institutions that promote agriculture come in many forms, and one of the more complicated sets of arrangements are those that support collective action where different stakeholders work together at various levels to create shared benefits. The next section highlights the significance of collective action in dealing with challenges constraining agricultural development.

3.4.6 Collective action as a mechanism of achieving smallholder agricultural transformation

Evans (1996) argues that economic advancement is nurtured by synergies between different actors that complement each other. Policy documents often indicate that Governments seek to forge partnerships that foster overall economic development (Booth 2012). Mechanisms of learning by doing through knowledge transfer are filtered via discourse coalitions. It would therefore not just what we know but with whom we interact and on what terms (Sidebottom, 2016 Page 55). This section examines scholars' views on the effect of partnerships and collective action on the agricultural development.

State-donor partnerships can enable the state to provide resources to citizens (Brown (2015). However, navigating such relationships can be complicated, and in some cases, stakeholders fail to agree on the most appropriate path. While donors provide technical and financial support, they each come with conditions and often imposed their version of development on recipient countries (Kayizzi-Mugerwa 1998). The experiences in Africa show that despite decades of experience, donors are sometimes confused about how to efficiently package, coordinate, and deliver aid to accelerate agriculture transformation and rural development (Eicher 2003).

Contemporary views on donor-based initiatives are that recipients should determine their development pathways (Abrahamsen, 2004). Yet receipts may lack the capacity, organisation, and commitment to translate policy into actions (Kayizzi-Mugerwa 1998). Countries able to control of their strategy and policy agenda, have been able to defend their position with donors and attract significant external funding (Whitfield 2010).

In the case of Africa, there is an increasing realization that the bulk of what is needed to advance agriculture and food production has to come from African governments (Eicher 2003, Darkoh 1989). Since 2003, African leaders have resolved to develop an African-led agricultural process based on the assumption that countries will raise investment, and that external partners will come forward and support the process (NEPAD 2011).

The diverse stakeholder ecosystem that exists in the African agricultural sector that includes farmers, governments, donors, and the private sector has the potential to drive a Green Revolution in Africa (AGRA 2018). However, most countries have not yet determined how to foster these relationships to generate and sustain agricultural growth. Although many good initiatives exist, there is often limited institutional capacity within countries to harness donor and private sector investments and capacities to push the agricultural agenda forward (Poulton and Macartney 2012).

As studies have shown, private sector involvement in agriculture is low, with most investment directed towards non-traditional high-value crops (Nomathemba 2010). The earlier sections of this chapter show that one of the causes of limited private sector engagement in agriculture is the related infrastructural constraints in rural areas. Public-Private Partnerships (PPP) are new collaborative ways that seek to address the problem of entry and increase private sector participation in agriculture (Poulton and Macartney, 2012). This cooperative mechanism enables public entities and the private sector to benefit from shared resources. The World Bank recommends the PPPs approach as the first step towards the full privatization of input delivery systems (Morris et al. 2007).

However, PPP success stories are rare in agriculture: in most cases, the benefits to smallholder farmers are undermined by underlying weakness and failures within partner organizations (Poulton and Macartney 2012). Although the arrangement between the public and private sectors can provide services that meet public sector objectives, most African countries have a weak capacity to design and monitor PPP contracts. In areas where the PPP approach has been successful, this has led to an increase in income for smallholder farmers.

Narrod et al. (2009), using examples from Kenya and India, show that collective action through cooperatives in those countries led to complementary public-private partnerships that facilitated smallholder access to markets. They demonstrate that while the government mobilized farmers and offered training, the private sector provided input and output markets. Similarly, the Ugandan oil palm Private Public Producer Partnership (4P) has sustained significant income increases for rural and smallholder farmers (IDS 2015). While the PPP approach tends to favour cash crop growers and has issues of capacity, PPPs can be conduits of new technologies, infrastructure, and markets for rural farmers.

Infrastructure, particularly irrigation, is essential when considering attracting private sector investment into primary production. The goal of increasing crop yield and reducing hunger has invited commitment and renewed investment through donor-funded irrigation programs (You et al. 2011). However, one big challenge has been to develop sustainable management models for irrigation systems (Aarnoudse, Closas, and Lefore) 2018). Studies recommend that building grassroots institutions that enhance efficient management of irrigation schemes should be complementary to donor-government investment in hard irrigation infrastructure (Muchara, Ortmann, and Mudhara 2014, Easter and Zekri 2004). Analysis undertaken in Kenya shows that benefits to farmers can be minimal if irrigation schemes lack strong regulations, community ownership, and organization (Blank et al. 2002). To avoid dysfunctional irrigation schemes, therefore, the involvement of local-based organizations is encouraged.

Ostrom argues that users can sustainably overcome the collective action problem in natural resources management (Ostrom 2000; Ostrom 1990). This is because small groups can organise themselves and set clear management rules, suctions, boundaries, and manage shared resources. This theory, backed by stories of communities successfully managing natural resources (see for example, Meinzen-Dick, Raju, and Gulati 2002), supports the Water Users Association idea.

Water users Associations (WUAS) are the most prominent water management approach used, where users are involved in irrigation scheme management and decision-making. The associations are non-governmental, non-profit entities established and managed by groups of farmers along irrigation systems (IWMI and SICWC 2003). The establishment of WUAs is centered around two roles: (i) user participation in decision-making at the WUA level; and (ii) cost recovery of operation and maintenance (O&M).

The argument promotes the cost recovery narrative that since farmers benefit directly from irrigation projects, they should pay for O&M costs and a portion of the capital costs of irrigation systems (Easter and Zekri 2004). With increasing investment in irrigation, particularly in Africa, it is believed that entrusting water users with the responsibility of cost recovery will lead to the positive performance of the schemes. However, countries have found implementing the WUA's approach challenging.

This section highlights some of the essential features and benefits of partnerships and collective action in agricultural development. The nature of interaction and partnerships between key stakeholders, principally the state, donors, and the private sector, influence the trend and pace of agricultural development. The outcome and the effectiveness of collective action depend on the clarity of the goal and routes to achieve them. Chapters 7 and 8 of this thesis analyses the role of collective action in Rwanda’s agricultural development process.

The literature review provided in this chapter underlines agricultural development as a complex phenomenon. It shows that the process of initiating agricultural transformation requires an array of interventions able to expand the resource base for rural farmers. Key drivers of change that seem to dominate the agricultural development narrative are policy, institutions, and technology: The theories of agricultural change described and evaluated in the literature review are used to develop a conceptual framework through which agricultural development in Rwanda is analysed.

The next chapter discusses the conceptual framework, along with a description of the data collection methods and research methodology used in this research.

Chapter 4: Research Methodology

The previous chapters stated the research objectives and examined the relevant literature. To shed light on the processes and pathways of smallholder agricultural development in Rwanda, my research relies heavily on primary data. This chapter outlines my conceptual framework, data collection approaches, interviewees and the location of the study.

The chapter is divided into five sections. Section 4.1 examines the conceptual framework and the research question. Based on analysis of the research question, section 4.2 outlines the methodological approach and discusses the characteristics of the different methods used to gather data. Section 4.3 explains the different sampling methods and how participants were chosen, while section 4.4 sets out the data analysis an approach used. Section 4.5 canvasses the scope and the limitation of the research design.

4.1 The conceptual framework and research question

Drawing from the empirical and theoretical literature discussed, this section develops an analytical framework adopted throughout this thesis. The literature reviewed in Chapter 3 shows that no single comprehensive theory of agricultural change can satisfactorily integrate all the driving elements, and the interactions between them, in a consistent framework, although different models and arguments contribute to an explanation of the complex mechanism through which agricultural grows.

The literature underlines political commitment and policy, institutions and innovation as key drivers of agricultural transformation. In most countries, particularly those in Africa, agriculture is subsistence, dominated by poor smallholder farmers who operate under difficult rural conditions. Despite these realities, as discussed in Chapters 1, 2 and 3, from 2000, Rwanda registered considerable agriculture improvements, following a combination of Government interventions. The purpose of this research is to understand, from the stakeholders' perspective, the circumstances under which agricultural change occurred.

The conceptual framework for this thesis builds on an institutional economics perspective (Kirsten et. al. 2009) to address its research topic of understanding the formulation and implementation of agricultural policy in Rwanda., by focusing on how Rwandan policies and institutions affect smallholder agriculture. It builds on the accepted understanding in the field of institutional economics that African countries need to achieve sustainable intensification through their agricultural policies (Dorward, Kydd and Poulton, 2005).

The study of the outlier case of Rwanda, that has been able to succeed in achieved sustainable intensification of agriculture is particularly important, given that there is a greater incidence of failures in sub-Saharan Africa. The failures have been attributed to high transaction costs and poor information flows (Dorward, et. al. 2009). This thesis draws on these findings in institutional economics as it seeks to identify how the introduction of a state-led agricultural policy, which has adopted in Rwanda, has attempted to reduce the phenomenon of weak markets by bringing in explicit features of 'development coordination' into the design and implementation of agricultural policy. It takes up the call in the handbook for professionals, *Institutional Economics Perspectives on Agricultural Economic Development* that call from a move from abstractions of African agriculture, and the thesis attempts to understand how Rwanda's state led agricultural strategy dealt with the presence of information asymmetries and high transaction costs (Kirsten, et. al. 2009).

The thesis deploys the concept of the 'developmental state', a term that was first introduced by Chalmers Johnson in 1982, to distinguish the development trajectory of the Japanese economy from that of countries that had undertaken their development strategies over the course of the nineteenth century. The concept was broadened to examine the development trajectories of countries in Latin America and Asia by Peter Evans, in the 1990s, and has come to be understood as a model of state led development, where the state has the ability to engage with a large number of societal stakeholders while being able to make independent policy decisions, that gave rise to the characteristic of 'embedded autonomy' (Evans, 1995). The leading role of the state in designing, directing and even implemented economic growth strategies has also been regarded as a necessary feature for countries that were 'late developers', and which had to contend with the already advanced capitalist production and trading opportunities, that characterized the economies of countries that had developed in the nineteenth century.

The importance of state-led development policies has become particularly relevant for understanding agricultural policies with the contributions of institutional analysis based on the key characteristics of New Institutional Economics (NIE) and Institutional Political Economy (IPE) by the end of the 1990s (Harris, Hunter and Lewis, 1996). The core concept of transactions costs that arose on an account of the large informational asymmetries that exist in agricultural markets became well-established, particularly with regard to understanding why agricultural markets had not been better placed to support the development of the national economy in countries in sub-Saharan Africa (Bates, in Harris, Hunter and Lewis, 1996). The intertwining of the developmental state literature and the emerging field of development studies drawing on institutional analysis provides a powerful intersection to analyse the impact of agricultural strategies in African economies today.

The consideration that the relationship between the state's policy making and the ability of the state to work with other societal stakeholders to reduce the large transaction costs – exorbitant costs of transport due to low density of roads, limited knowledge of restoring agricultural lands due to protracted periods of war, lack of knowledge of how to ensure agricultural intensification to ensure increased household income – follow on from Migdal's classic thinking on state-in-society and his depiction of struggles and accommodations between state and society and the resultant types of outcome: total transformation, state incorporation by social forces, incorporation of the state, and disengagement by the state (Migdal, 1994: 24).

Using Migdal's own classificatory scheme, it is indeed the case that in the absence of an active civil society in the face of a genocide, the case of Rwanda approximates Migdal's conception of total transformation, which takes place when the state uses processes of co-optation or subjugation of local social forces in the face of prolonged civil war on unrest. Migdal's scheme seems to tally with the development trajectory of China in the early decades of national development. The case of China has been analysed extensively in the development literature, and this is an attempt to examine the Rwandan state through the lens of a developmental state. While the notion of the developmental state having been devised to conceptualise the East Asian development experiences, shows that many countries in Asia have failed in their ability to ensure that balance of autonomy and embeddedness, this analysis has not been widely used to study the Rwandan experience.

The concept of the 'developmental state' has come in for criticism, and in anthropological thinking it is regarded as an 'authoritarian high modernist' form of the state where technical expertise is applied in a top down manner through untrammelled power and where civil society is not allowed to thrive (Scott, 1998: 88-89). This view has been adopted by Huggins (2017 p. 1), though he does recognise that the Rwandan state has not failed to deliver agricultural policy but regards it as suspected of coercive practices and an inability to engage with civil society (Huggins, p. 42-43.).

There is a larger range of understanding regarding variations of state policy that fall within the concept of the 'developmental state' within the development economics literature that does not regard the term ‘authoritarian’ as necessarily a recipe for a failed state policy: Cummings uses the notion of the ‘bureaucratic-authoritarian-industrialisation regimes’ (BAIR) to represent the successful East Asian economy experiences in the mid and late twentieth century (Cummings. 1999:70). The range of country experiences that fall within the broad classificatory term of ‘developmental state’ continues to be regarded as a valuable framing in development studies as it focuses on the imperative for state-led development policies in the face of poorly functioning markets.

The core research question of this thesis asks: **What are the key drivers of smallholder agricultural change in Rwanda?** In order to answer this question it is necessary to isolate and identify events and experiences that have led to agricultural change. The following 4 sub-questions are asked, in order to fully address the research question:

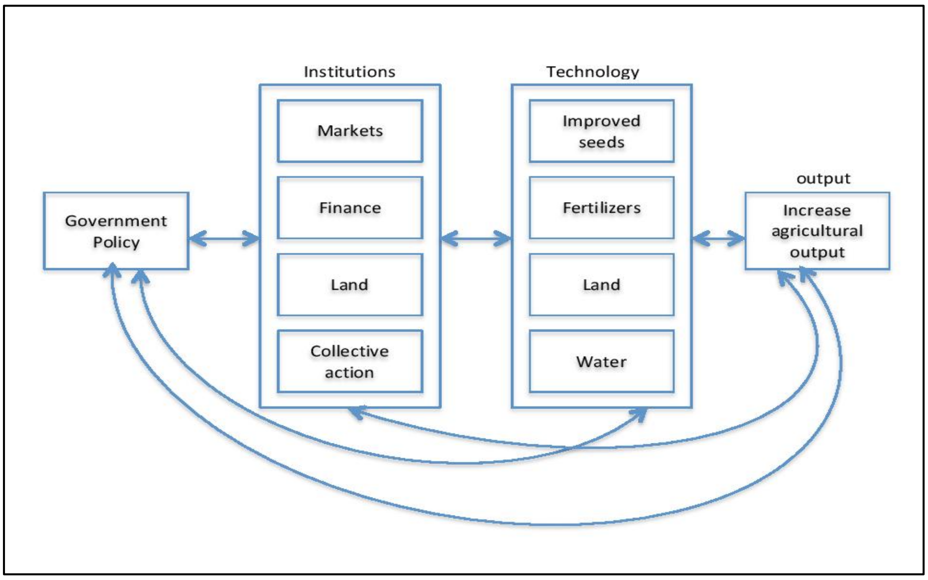
1. Why did Rwanda prioritise smallholder agriculture?
2. What mechanisms were used to stimulate agricultural change?
3. What was the impact, particularly on rural smallholder farmers?
4. To what extent did agricultural reforms influence agricultural productivity and commercialisation?

The review of the literature suggests that appropriate government policy, institutions, and technologies all inspire agricultural improvement for smallholder farmers. Although these concepts appear familiar, the challenge lies in how they can be applied to efficiently generate improvement for rural smallholder farmers.

The approach adopted by this thesis follows the institutional economics synthetic model provided in the handbook for professionals, *Institutional Economics Perspectives on Agricultural Economic Development* (Kirsten, et. al., 2009) that was written specifically with the focus on ‘policies and institutions that affecting smallholder agriculture’ (p. 17), and establishes the rationale for an agricultural development policy that is pragmatic and inclusive, which they term as 'developmental coordination' (p. 29). In particular, the emphasis is on the 'how' rather than the 'what' or 'why' of the design and implementation of agricultural policy.

The methodology adopted by this thesis is built on the understanding that it recognizing that agricultural change is a result of ongoing decisions and undertakings by farmers is the most appropriate approach to assessing the the effectiveness of Rwanda's agricultural reforms (Chambers 1963). The research design takes into account the importance of overcoming the tendency of the researcher to display 'strategic ignorance' that is demonstrated by 'deliberating not knowing or not wanting to know' (Chambers, 2017: 28) by engaging with how farmers experienced the agricultural reforms. In bringing together the institutional economic framework and the participatory methodologies the research design was developed through using the analytical framework described in Figure 4.1.

Figure 4.1: Conceptual framework for analysing agricultural development in Rwanda



Source: Own diagram derived from multiple sources (Kirsten, et. al., 2009; World development 2008; Dorward, Kydd and Poulton, 2005; Johnson, Hazell, and Gulati 2003; Chambers 1963)

Transitioning from low to high agricultural productivity is a multifaceted process, with a web of complexly interlinked drivers. Given the complexity, this conceptual framework provides a lens through which the process of agricultural development can be analyzed (Figure 4.1). The analysis is threefold, looking at policy, institutions, and technology as key aspects of stimulating agricultural growth (Hazell et al. 2006, World Development Report 2008).

In poor countries, the process of smallholder agricultural development relies on government policies and intervention (Dorward et al 2004, Johnson, Hazell, and Gulati 2003). Government policy provides the institutional and technical framework necessary to stimulate increased output. Increasing agricultural output often requires farmers' access to high yielding seeds, fertilizers, advisory services, irrigation and infrastructure (roads, postharvest, communication), often limited in rural areas.

In addition to technical innovations, increasing agricultural output calls for institutions that enhance collective action, and access to rural finance and markets (WDR 2008). Getting markets moving may entail concerted government efforts to engage with, and ultimately enhance, the role and performance of the private sector in agriculture (Gabre-Madhin 2009). This process might require institutional changes that improve land tenure security and encourage private sector investment into the agricultural sector. These institutions became enablers of agricultural change at the grassroots level (Peter Hazell et al. 2006).

Once agriculture begins to develop and farmers' output begins to increase, this process may stimulate new policies, institutions and technologies to sustain growth. This indicates that countries have to remain responsive to the changing needs of farmers during the different stages of agricultural development to maintain the vicious circle.

Rwanda's policy goal is to facilitate farmers' transition from subsistence to more market-oriented farming, in order to boost output and rural income.

That is why, CIP the main driver of agricultural transformation, focuses on introducing high yielding technologies to rural farmers to increase productivity (see Chapter 2). The primary goal of CIP is to meet the country's economic and food security.

Food production in Rwanda is dominated by small-scale farming. The characteristics of a smallholder farmer in Rwanda are aligned to those described by FAO. FAO's definition of a smallholder depends on the agro-ecological zone: "in favorable areas with high population densities they (smallholder farmers) often cultivate less than one hectare of land, whereas they may cultivate 10 ha or more in semi-arid areas, or manage 10 head of livestock" (FAO 2004).

Rwanda's focus on smallholder farmers has generated positive results (see Chapter 2). The main purpose of this research is to grasp, why smallholder agriculture was prioritised, the process through which agricultural problems are diagnosed, policies designed and implemented. To have larger view of the agricultural transformation process, this research involves a wide range of stakeholders including farmers.

4.2 Strategies of inquiry

From the outset of this research, given the nature of the research questions and the multiple actors involved in agriculture, the data to be used was intended to reflect a balanced variety of sources at the national, provincial, district, and village levels. The aim was to use the data collected from these sources to generate theories to explain smallholder agriculture development. Therefore, the overall strategy for this research was to use grounded theory. Grounded theory, a method often used in social sciences studies, enables the researcher to develop theory on the basis of the data collected (Punch 2005). Using this method of inquiry, information drawn from different actors can be collected using different approaches.

This research uses the mixed method approach to enable a holistic assessment of the research problems. Combining qualitative and quantitative methods facilitates collection of data using different strategies where the resulting mixture promotes complementarity. Since each method has flaws and limitations, the mixed method approach is seen to reduce biases inherent in using a single method (Green, Caracelli, and Grahan Wendy 1989). The intention is to exploit the strength of each approach while compensating for their weaknesses (Punch 2005).

One important attribute of using a mixed method approach is the sense of extensiveness it provides. Johnson and Onwuegbuzie (2004) recommend the mixed method approach as one that gives a comprehensive account of the area of inquiry by examining rich phenomena such as intentions, experiences and culture embedded in the local context.

In this study, qualitative and quantitative methods are used sequentially. The research has on a three-phased design where data collection starts with in-depth qualitative interviews that involve only a few elite individuals, followed by focus group discussions and a survey with a larger sample, which converges the qualitative and the quantitative. A dominant/less dominant design approach was used for the survey questionnaire, involving mainly structured questions, with a few open ended questions (Cresswell 1994).

Starting with qualitative elite interviews provided information that was useful in refining the survey questionnaire and group discussions. Both the strands of data from qualitative and quantitative method were collected, analyzed and integrated to answer the research question (Creswell and Plano Clark 2011). While the quantitative method was useful in showing relationships between variables, the qualitative research explained factors underlying the broader relationship (Punch 2005). The two sets of data were triangulated to provide a comprehensive picture of the results and to enhance their validity.

4.2.1 Qualitative approach: interviewing the main actors

The qualitative research method is a source of well-grounded, rich descriptions of the processes identifiable in local context (Miles et al. 1994). The method explores perceptions and generates rich and detailed responses from research participants. As such the method tends to deal with few individuals and generate textual data that explain events and the processes that connect them (Maxwell and Loomis 2003). In this study, qualitative research takes two forms, in-depth interviews and focus group discussion.

In-depth Interviews

As used in this research, in-depth interviews generated responses from key actors in the agricultural sector including farmer representatives. The objective was to acquire knowledge of the events, processes, experiences, and views from people who had been directly involved in agricultural policy development and implementation. In-depth interviews were conducted at the national, district and village level. The first set of inquiries involved policy makers and implementers at the national level. These included government advisors, ministers, MINAGRI staff, donors and agro-dealers (distributors of seeds and fertilizers). This group of interviews also includes the commissioner of Agriculture in the African Union (AU), although this had not initially been planned; after meeting at a conference in Kigali I decided to interview her to capture the African perspective on agricultural performance in Rwanda. With the exception of one interview done in Kampala, Uganda, the interviews at the national level were conducted in Kigali.

At the district level, the intention was to interview policy makers and implementers who were in frequent contact with farmers. This included local leaders (district mayors, sector executive secretaries, village leaders), agronomists, and agro-dealers (retailers). At the sector and village level, farmer representatives and change agents – people mentioned by farmers as being instrumental during the agricultural change process – were interviewed. Interviews at the district and village level were conducted concurrently, depending on the availability of respondents.

Thirty people in total were interviewed: 10 at the national level and 20 at the local level (5 in each of the four districts targeted). This number offered a chance to gain insight from a diverse group of people involved in agricultural development at different levels. For instance, at the district level participants ranged from the Mayor, Executive secretary, Village leader, agronomist, agrodealer, and lead farmers and selection depended on the level of involvement in agricultural transformation at any time in the study period.

Before each interview, a description of the project was given and a written note with details about the research project handed to the interviewee. Each respondent signed a consent form to allow the interview to be used for PhD research. In-depth interviews were guided by 8 open-ended questions, and each session was approximately an hour. All respondents consented to the recording of the interviews.

Interviews were not rigidly structured, allowing the interviewee to express personal views and give details about their experiences. The sessions were informal, giving participants time to reflect and to give insight on what they perceived as relevant and important in relation to the research questions. Interviewees expressed views based on their knowledge and experiences of the agricultural transformation process. In some instances, the interviews were not conducted as question and answer sessions; instead, respondents talked about their experiences chronologically and in some way responding to the different questions. In such cases, I asked questions and sought clarifications at the end of the session. As the research question warrants a historical perspective, a narrative delivery was then built from constructs of different interviews.

An example of the interview process can be seen in the case the first farmer I interviewed as a change agent in Musanze (Figure 4.2). He was among the first people to try using improved seeds and fertilizers in his village. As an experiment he apportioned a small piece of land to grow a new seed variety and use fertilizers. After more than doubling yield in the plot with the new seed variety, he increased the area given to the hybrid seed in subsequent seasons and mobilized neighbors to adopt the technology. Most farmers in that village now plant maize hybrid varieties, and have built a tower to monitor and view the maize crop from above. The respondent proudly took me to the tower and maize was planted as far as my eyes could see. The interview was conducted on top of the tower.

Two key themes that emerged during the interview with Emmanuel were those of working together to achieve a common goal, and finding collective solutions to local problems. This motivated questions about collective action in subsequent interviews. In addition to individual interviews surveys and group discussions at the farm level were conducted.

Group Discussions

The focus group is a participatory research tool that generates data using the qualitative research approach. While in-depth interviews involve a one to one dialogue between the researcher and a specific individual, focus groups are based on discussion amongst participants of a group, facilitated by the researcher (Nyumba et al. 2017). The technique is used to interview groups of people with relatively similar experiences to generate debate and collective views on a specific topic and to elicit the meaning behind those views. In this research, the method was used for deeper exploration of the changes and effects of agricultural development on rural livelihoods.

Preparations for group discussions were often made the day before, through farmer representatives, agronomists or village leaders. After explaining the research project to the local leaders in the specific study area, I would be provided with a contact person. The contact person would be an agronomist or farmers' representative who I contacted in case of further questions or issues arising during the interview in that area. In some cases, I mobilize the farmers, while in others, the contact person contacted them beforehand. The target was to convene groups of at least 10 farmers and have a 2-hour discussion. Most times I went with the contact person to a random farming community and asked farmers if they were willing to talk to me. There were often between 6 and 15 people willing to have a discussion. Depending on the availability some joined the discussion but in most cases the contact person left before the meeting.

As with the in-depth interviews, I described the research project prior to the group discussions. I was able to tell farmers my background with MINAGRI and the purpose of the research. Afterward, farmers willing to take part in the discussion expressed consent by signing against their name on an attendance list. Group discussions started with question one from the individual interview questions (Appendix III) but did not follow the question format of the individual interviews. Farmers mostly discussed changes that had occurred during the last 15 years, the change process, the problems encountered, and the solutions and lessons learned during agricultural development. Conversation varied depending on the group context; while some concentrated on experiences with irrigation, others talked about adopting new seeds.

Apart from two groups, which seemed suspicious of the motivations behind the study (see discussion in Section 4.5), I found groups diverse, interested and engaging. Where I detected suspicion in a group, I described the project again, emphasizing that the research was not an evaluation of performance but an opportunity to share agricultural experiences. In both cases, group members relaxed after the second explanation of the project. Discussions were often near farmers' fields and conducted in the afternoon at the end of a day's work, with each taking between 1-2 hours. Mostly, one group member and I facilitated the discussion to encourage full participation. All group discussions were recorded.

Considering that participants of each group were farmers who in most cases knew each other, this focus group approach allowed the researcher to develop a richer understanding of what farmers have experienced together over the last 15 years. Whereas in an individual interview setting a farmer is asked about their own views, the focus group setting allowed people to remind each other of key events and probe each other's reasons for holding a certain view. This method also allowed participants to challenge each other on ideas that might be inconsistent or inaccurate.

The idea of using different forms of interviews was to gain deeper understanding of the research question. The in-depth research helped illuminate the process of agricultural policy formulation, implementation and impact from many people's perspectives. Additionally, a survey was conducted to elicit other qualitative and quantitative aspects of the research.

4.2.2 Quantitative/qualitative: farmer's survey

The purpose of including a survey as part of this research was to assess the different aspects of a household, such as the means of livelihood, type of assets owned and agricultural systems used to produce food crops. The survey was conducted only at the grassroots level, as a means of generating information from farmers.

Quantitative research enables comparison between variables to find relationships among them (Maxwell and Loomis 2003). Using this method, the researcher is able to construct a situation that illuminates the confounding influence of many variables, allowing one to more credibly assess cause and effect relationships. Prompted by the nature of the research question, the survey method was adopted in order to quantitatively assess the features of social life of a large number of people.

The survey used a mixed modal approach, containing a few open-ended questions inspired by the qualitative interviews (Creswell 1994). The crosssectional survey conducted exploited aspects of both quantitative and qualitative methods, employing a small qualitative component with the bulk of the questions being quantitative in nature. Since most policymakers and implementers highlighted 'mindset' as one of the biggest challenges to the development of agriculture, open-ended questions in the survey questionnaire aimed to understand the motivation behind farmers' agricultural decisions. The questionnaire kept the first question of the individual interviews: 'Looking back, what agricultural changes have you observed in the last 15 years?' While the qualitative questions drew more on 'processual' context of agriculture development the quantitative ones aimed at understanding the 'structural' features of farmer's social life. The survey therefore captured temporal aspects and life stories that shed light on the agricultural development process in Rwanda.

Employing both qualitative and quantitative methods in the survey provided a means of establishing linkages among variables, and helped explain factors underlying their broader relationships, thus enabling triangulation. Structured and unstructured questions were systematically posed in a questionnaire in order to enable comparisons between farmers during the analysis. A survey questionnaire was first developed in English and later translated in Kinyarwanda since all the interviews with farmers were in the local language. Before the survey was conducted, the questionnaire was modified and refined during training sessions for fieldwork assistants, and after a one-day pilot in Musanze district. Table 4.1 sets out the fieldwork schedule, showing the timeline of the activities described in this section:

Table 4.1: Research method strategies and timelines

Phase	Timeline	Task	Methods and Instruments
Pre fieldwork	Jan –Feb 2017	Search for national data from official publications • Various fieldwork preparations • Selection of the of research area, district, sectors and villages • Identifying fieldwork assistants • Initial pilot of the questionnaire in Musanze district • Start of interviews with policy makers	Qualitative Archive search at MINAGRI
Phase 1 Elite interviews in Kigali	Feb-Mar 2017	• Interviews with policy makers and agricultural experts • Training of fieldwork assistants	Qualitative In-depth interviews
Phase 2: Interviews and group discussions at the district and village level	Mar-June 2017	• Interviews with policy makers agronomists, service providers, and farmer representatives • Farmers' group discussions	Qualitative In-depth interviews, Participatory research
Phase 3 Farmers' Survey	April-June 2017	• One on one interviews with farmers	Quantitative-Qualitative questionnaire

4.3 Sampling designs and the selection of participants

The sampling methods selected for this study are those associated with both qualitative and quantitative research. In a mixed method approach, sampling schemes are selected for both these components of the study, making the exercise more complex than in a single method study (Onwuegbuzie 2007). Onwuegbuzie (2007) shows that quantitative and qualitative samples can be related in various ways: they could be identical, nested, parallel or multilevel. This study generally takes on a multilevel relationship where sample sets for each method are extracted from different populations at the national, district and village level.

At the national level, the aim was to interview policymakers, MINAGRI staff, agro-dealers and donors. Donor representatives from the World Bank, FAO and USAID were included, reflecting their significant contribution to agriculture in Rwanda during the study period. Additionally, project coordinators of key donor-funded projects were part of the study. Given their involvement in agricultural development processes in Rwanda, representatives from the African Union (AU), Alliance for a Green Revolution in Africa (AGRA) and East African parliament were also interviewed.

At the district level, participants included mayors, agronomists and agro-dealers, and farmers' representatives. Farmers' representatives included cooperative leaders, lead farmers, and village leaders. Farmers' representatives, agronomists and agro-dealers at this level were selected from either the district or the sector depending on availability. For each category one on one interview, similar to those undertaken in Kigali, were conducted at the district level.

At the village level, farmers were either selected for the survey or invited for group discussions. Although independent of each other, the interviews at the district and village occurred simultaneously in order to save time and minimize fieldwork costs. Respondents' involvement was voluntary and depended on both availability and the level of engagement in the agricultural sector. While the number of people included in the survey was predetermined, the sample size for the discussion groups was flexible.

Sandelowski (1995) highlights that the adequacy of a sample size is a matter of judgment. Looking at qualitative research she recommends that a sample sizes should not be so small as to make it difficult to achieve data saturation or so large that it is difficult to undertake deep analysis (Sandelowski, 1995). An adequate sample size is therefore important in determining the extent to which one can make analytical and statistical generalizations. According to Onwuegbuzie (2007) an optimum sample size should be one that generates sufficient data that helps improve representation, has a realistic chance of data saturation, and adequately responds to the research goal.

The number of participants targeted for this research was 366 people, including 30 for qualitative individual interviews, 288 for the farmers' survey and 48 for focus group discussions. Participants were selected using different sampling methods.

4.3.1 Sampling methods: choosing study locations and participants

Given the potential for the research to generalize qualitative and quantitative findings to the population from which the sample was drawn, both random and non-random sampling methods were used to select participants. In such cases, a multilevel sampling method is ideal (Onwuegbuzie 2007; Kemper, Stringfields, and Teddlie 2003). In this research participants selected for qualitative interviews were chosen using non-random methods while those in the survey were chosen randomly.

Snowballing: Identifying Participants for Qualitative Interviews

The in-depth interviews conducted were explorative and descriptive, seeking to discover information from people who were involved in the agricultural development process in Rwanda, the snowballing method of selection was deemed appropriate. Although this sampling method is in no sense random, it is convenient and facilitates access to participants relevant to the study (Atkinson and Flint 2001). It is an informal method of selection that takes advantage of social networks to enable linkages to potential contacts unknown to the researcher. Having worked at MINAGRI-RSSP from 2008 to 2015, I had connections that enabled me find people who had been involved in the initial processes of agricultural policy formulation prior to my time in the ministry.

At the district and village level, snowballing was also used to locate people who were critical to the process of agricultural transformation. During meetings with local leaders or farmers, names and contact details of change agents in the areas were provided. I found that in unfamiliar areas, being introduced to community members by an opinion leader was an added benefit.

Purposive Sampling: Choosing Research Sites

Alongside this snowballing approach, the purposive sampling technique was also beneficial in locating relevant people. The purposive method of data collection aims to establish good correspondence between the research question and sampling method (Bryman 2002). It entails categorization and selecting interviewees according to the emerging theoretical focus. Therefore, in an attempt to avoid missing key participants relevant for this research, districts and sectors were selected purposively according to different themes. The next section explains the approaches to selection of the Districts, sectors and households examined for the study.

Selecting Districts

The selection of districts, sectors and households for inclusion in this research was made using a mixture of methods; these were purposive sampling, stratified random sampling and random sampling. The intention was to select a representative sample that embodied the varying agricultural contexts in the population. Given the approach to resources distribution across districts, differences in agricultural performance were attributed to other factors. [39]

During my work at MINAGRI, I noted that agricultural performance in Rwanda varies according to locations. Whilst some districts have registered impressive increases in agricultural output, production for others has remained low. Prompted by a desire to understand the underlying factors behind the disparity, this research aims to investigate participants from both those areas

---

[39] Resource allocation in districts is discussed at Chapter 2.2.

known to perform well in agriculture, and those that struggle. Since there was limited data on agricultural performance per district, the first challenge was to find proxies for agricultural performance. After considering various options, I decided to use food security, on the basis that agriculture and food security are intrinsically linked. The use of food security was also facilitated by the existence of the 2015 Rwanda Comprehensive Food Security and Vulnerability Analysis (CFSVA) report, which provides the food security status of each district (World Food Program 2015).

This study shows that around 20% of households in Rwanda were food insecure[40] in 2014. Accordingly, the research strategy for this thesis adopts this national level of 20% in 2014 as a threshold, and groups districts according to the proportion of food insecure households. Districts with food insecurity level of 20% and below were placed in Category 1 while those above 20% were in Category 2.

Assuming that food security is a good indicator of agricultural performance, Category 1 districts were considered high performers and Category 2 as low performers. For the purposes of this study, the 27 rural districts in Rwanda were assigned one of these two categories: 14 districts were in Category 1, and 13 were in Category 2. After this stratification, the next step was to randomly selection two districts from each category by casting lots. Gatsibo and Musanze were chosen for Category 1 as high performers in agriculture while Nyamagabe and Nyanza represented low performing districts in Category 2 (Table 4.2).

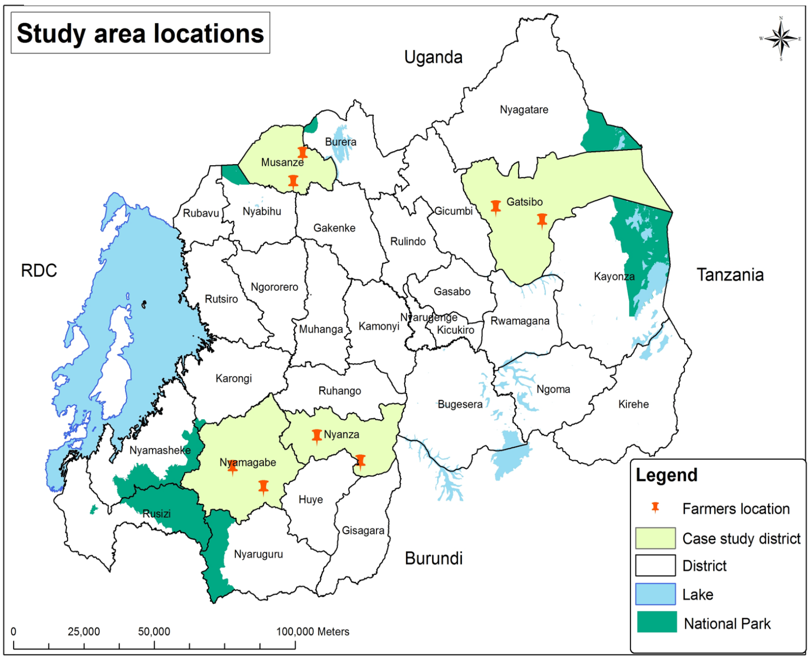
[40] Food insecurity is defined in the report: 'Significant food consumption gaps. These households use a high share of their budget to cover food needs and the majority of households have to use negative coping strategies in order to make a living, although only a few use the more serious coping strategies.' (WFP 2015, page 15).

Table 4.2: District selected for the study according to performance categories

Category	Cat One: Lower % of food insecure households (<20)	Cat Two: Higher % of food insecure households (<20)
District	Musanze (20%) Gatsibo (15%)	Nyanza (34%) Nyamagabe (43%)

Source: WFP 2015

Figure 4.2: Locations of the sampled districts

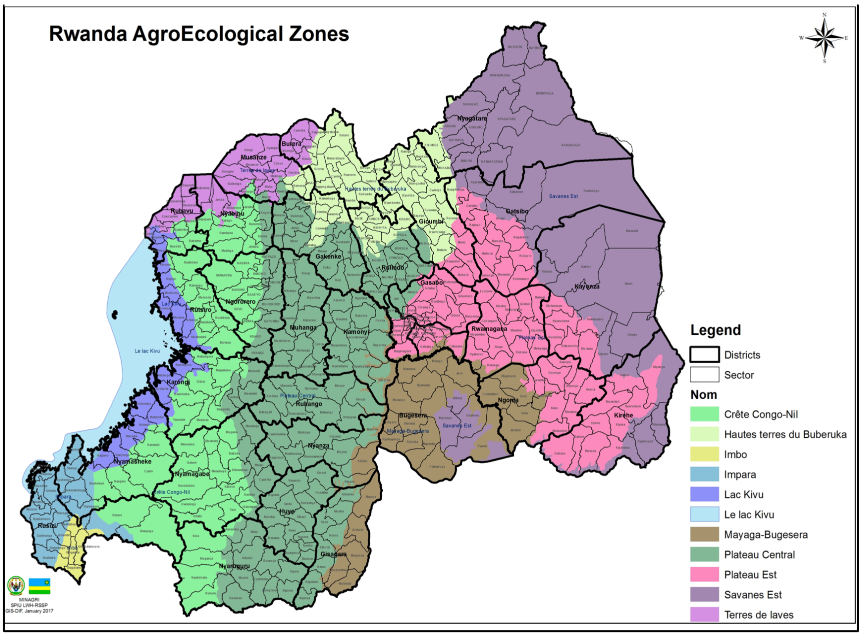


Source: Author's own

It can be seen that the districts selected had different levels of performance: Nyamagabe had the highest percentage of food insecure households while Gatsibo had the lowest, and whereas Musanze had marginal performance, Nyanza had 14 percentage points higher than the 20% cut off assigned for this research for sampling purposes. Figure 4.2 shows the location of each district selected.[41]

Although agro ecological zone was not a factor considered during district selection. Each district selected was found in a different agro ecological zone (Figure 4.3). Agro ecological conditions are some of the most critical factors influencing agricultural performance. Agro ecological zoning is necessary for agricultural development and planning as it classifies areas according to soils, landforms and climatic conditions (FAO 1999). The most relevant climatic parameters related to crop production are rainfall and temperature (Verdoodt and Van Ranst 2003). As shown in Figure 4.3, Rwanda has 11 agro-ecological zones. Given the significant influence on agricultural performance, agro ecological zones played an important role in the selection of sectors.

Figure 4.3: Agro ecological zones in Rwanda



Source: MINAGRI

[41] This map has already been shown in the introduction

Selecting Sectors

Similar to the process applied to the selection of districts, sectors were selected in two stages: firstly, they were categorized according to their agricultural performance, then, secondly, according to their agrological zone. The first stage of selection was made with the help of MINAGRI staff and district agronomists. Given their experience in working with sectors, I asked for the performance of the sectors in the district I had selected. Using the information provided, sectors in each district were listed according to their agricultural performance. Although this process was subjective, it provided a basis for the ranking of sectors, from those perceived to be the best performers, to those performing worst.

After verifying this information with farmers, I found that sector performance was generally known at MINAGRI, district and farmer level, particularly in relation to the best and worst performers, with judgment of agricultural performance being based on relative differences in soil fertility, agricultural output and farmers' uptake of improved seeds and fertilizers.

Table 4.3: Nyamagabe sectors ranked according to agricultural performance

Number			**District**
1	Buruhukiro	10	Cyanika
2	Gatare	11	Kaduha
3	Nkomeno	12	Musange
4	Uwinkingi	13	Mugano
5	Kitabi	14	Kibubwe
6	Musebeya	15	Mbazi
7	Tare	16	Gasaka
8	Mushibi	17	Kamegeri
9	Kibirizi		

Source: MINAGRI and Districts

An example of this ranking process, showing sectors in Nyamagabe district listed in descending order according to performance, is given in Table 4.3. The idea was to pair one best and one worst performing sector belonging to the same ecological zone: after ranking the sectors, one sector from the five best performing sectors and another from the five worst performing ones were randomly selected using the casting lots method. Once the randomly selected sector pairs were found to be in a similar ecological zone, that selection was final. In the event that the sectors selected were in different agro-ecological zones the selection process was repeated for one of the categories until the paired sectors were in the same zone.

In each district participants were selected from the same agro-ecological zone to control for ecological differences. However, I was aware of the practical difficulties of keeping within an agro ecological zone during the actual interviews. The plan was to mark participants that fell in different ecological zone and pay attention to any differences during data analysis. Interestingly, all participants in each district were in the same ecological zone except for Nyanza where because of terrain 18 farmers out of 72 were in a different agro-ecological zone. This difference will be acknowledged during data analysis. Broadly speaking, selecting sectors from the same ecological zone minimizes the chances that the differences in agricultural performance were due to variations in soil type and climate conditions.

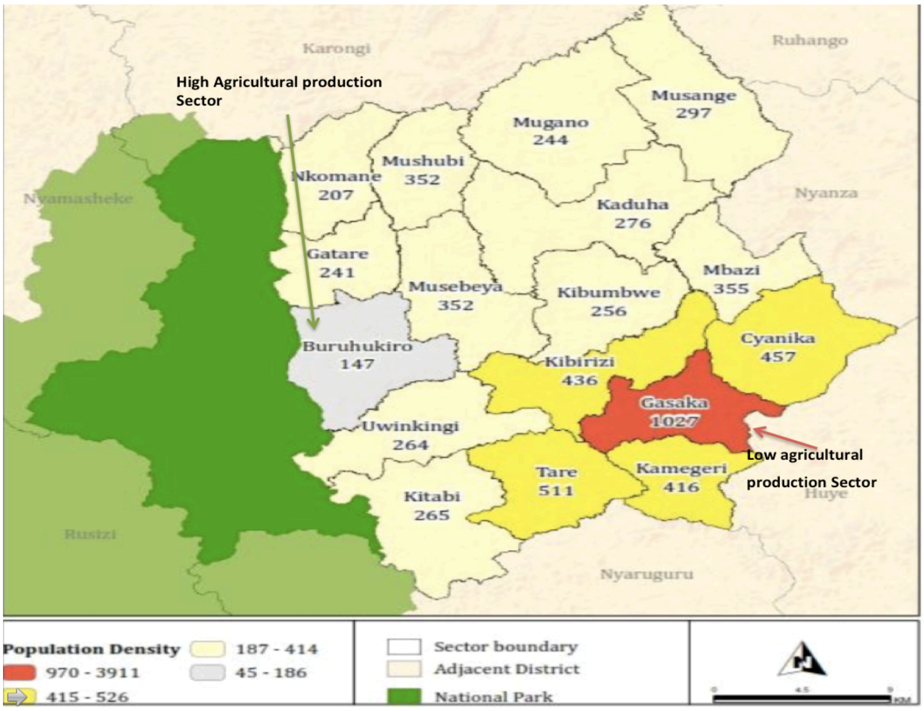
While the level of food security was used as criteria for district selection, agricultural performance and agro ecological conditions were also key factors in sector selection.

4.3.2 Characteristics of sampled districts and sectors

This section describes some of the key characteristics of the districts and sectors selected for this research. Starting with the districts with poor agricultural performance, the section highlights some of the physical and social differences in the study areas.

Nyamagabe District

Figure 4.4: Location of sampled sectors in Nyamagabe district

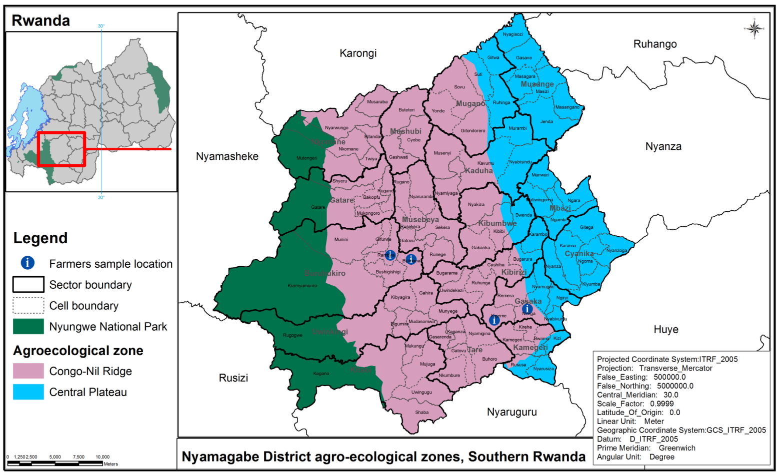


Source: NISR 2015

Nyamagabe district is in the southern part of Rwanda, having a population of 341,491 and a population density of 313 people per km^2 (National Institute of Statistics of Rwanda 2015c). Around 96% of the population is rural with agriculture as the main source of livelihood. Buruhukiro was selected as a high agricultural performing sector, while Gasaka represented the low performing ones. The two sectors are on opposite ends of the population spectrum (Figure 4.4). While Buruhukiro sector is predominantly, rural with the lowest population density in the district, Gasaka has the highest population and about 40% of the people are urban (National Institute of Statistics of Rwanda 2015c). Gasaka also has the highest number of immigrants in the district.

Figure 4.4 shows the map of Nyamagabe district and the locations of sectors where the research was conducted. The sectors are located in the Congo-Nil Ridge agro climatic zone (4.5). This zone is characterized by high slopes that range from an altitude of 1900 to 2500m (Verdoodt and Van Ranst 2003). Although inhabitants tend to improve soil conditions for crop production, most soils are less productive for tropical crops. The district is also often cited as one of the poorest districts in the country (National Institute of Statistics of Rwanda 2014).

Figure 4.5: Agro ecological zones of Nyamagabe District

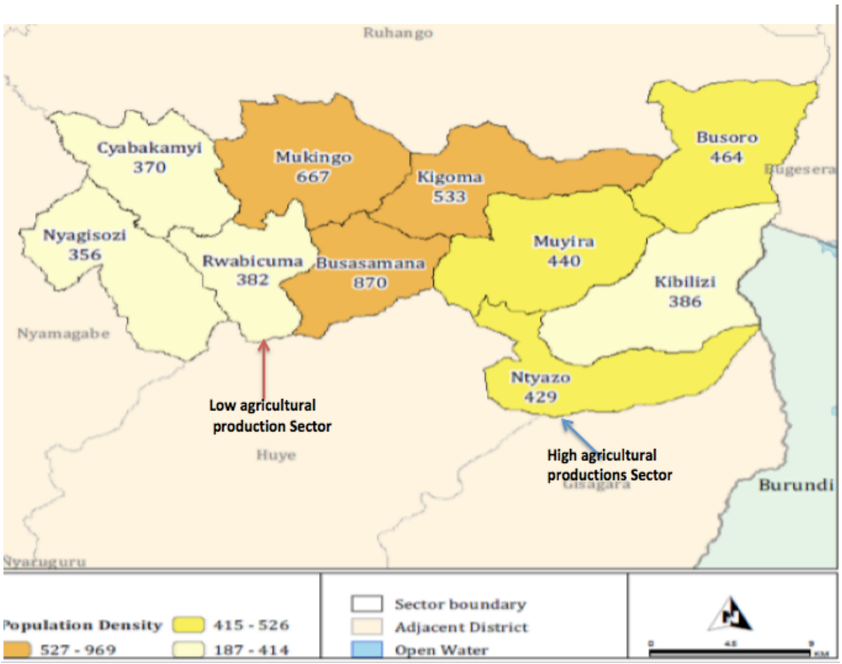


Source: Author’s own

Nyanza District

Nyanza district is also in the southern part of Rwanda, with a population of 323,917 people and a population density of 482 people per km^2 (National Institute of Statistics of Rwanda 2015d). Compared to Nyamagabe, the district has a slightly lower population but higher population density. The two sectors selected for this study are Ntyazo, a sector identified as having good agricultural performance, and Rwabicuma, chosen from the poorly performing ones. While Ntyazo has a high population compared to Rwabicuma (Figure 4.6), the two sectors are predominantly rural with very few immigrants. Nyanza is among the districts with a high proportion of household in extreme poverty (WFP 2015). Figure 4.6 show the map of Nyanza highlighting the location of the study.

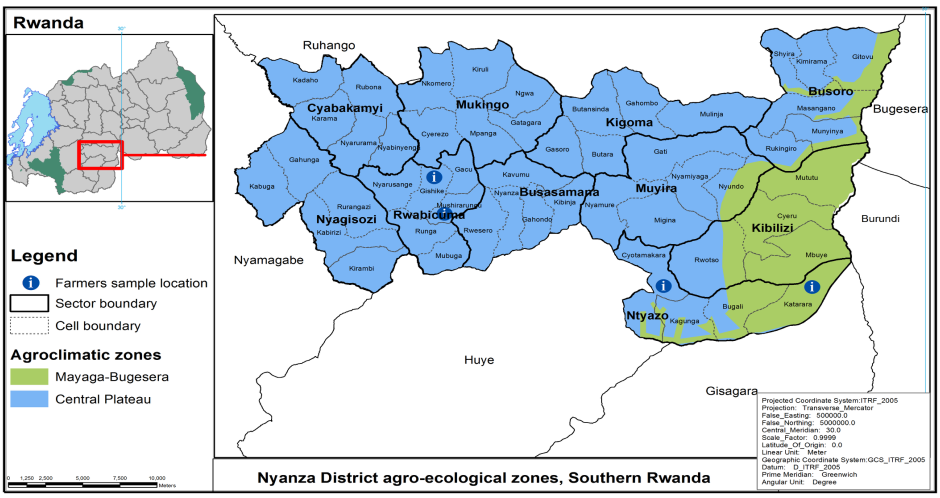
Figure 4.6: Sampled sectors in Nyanza district



Source: NISR 2015

Figure 4.7 shows that most of Nyanza district is in the Central Plateau zone. The Central Plateau ecological zone has an average altitude of about 1700m. In this zone soils are suitable for the production of a wide range of crops (Verdoodt and Van Ranst 2003).

Figure 4.7: Agro ecological zones in Nyanza District

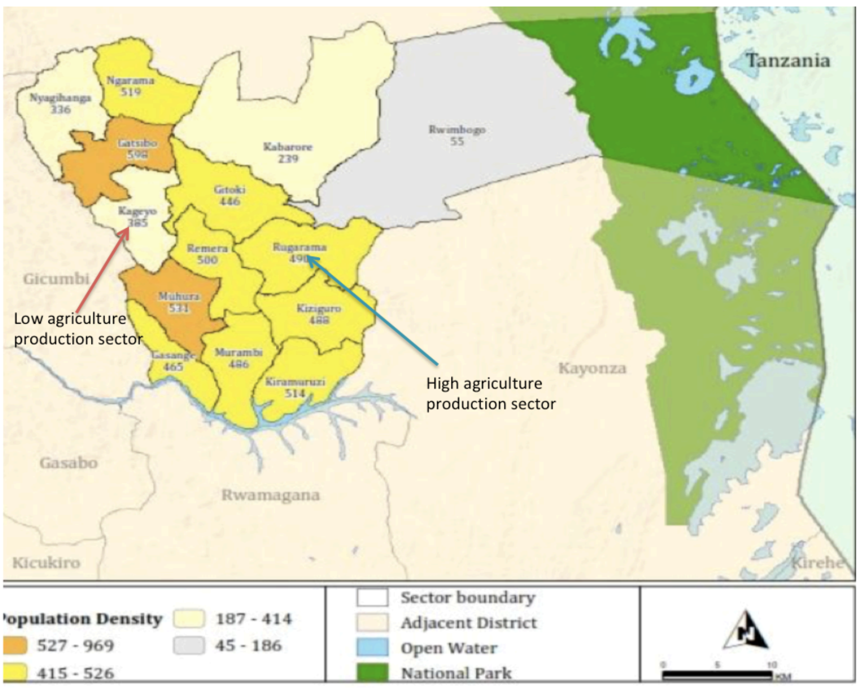


Source: Authors own

Gatsibo district

Gatsibo is one of the districts selected from the high performing category. The district is located in the eastern part of Rwanda and has a population of 433,020 people and a population density of 274 people per km^2, the lowest among the four districts (National Institute of Statistics of Rwanda 2015a). Gatsibo sectors identified for the study are Kageyo, representing lower agricultural performing sectors and Rugarama, representing high performing sectors. Both sectors are rural, with Rugarama having a higher population density than Kagayo (Figure 4.8).

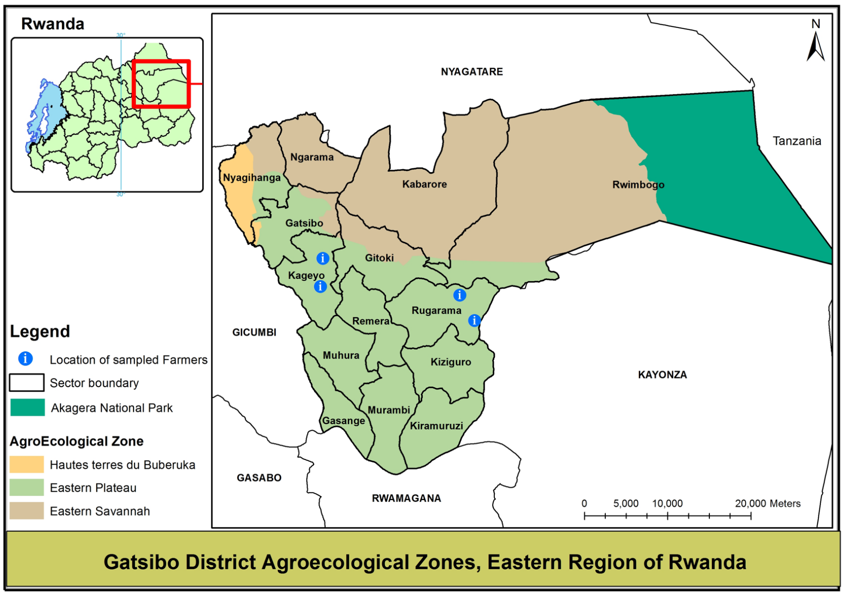
Figure 4.8: Location of the sampled sectors in Gatsibo District



Source: NISR 2015

The district is located within the three ecological zones of Eastern Plateau, Eastern Savannah and Heutes Terres du Buberuka (Figure 4.9). The selected sectors are in the Eastern Plateau agro-ecological zone, which is characterized by hills with large and fertile horizontal hills tops but with strongly eroded slopes (Verdoodt & Van Ranst 2003).

Figure 4.9: Agro ecological zones in Gatsibo District



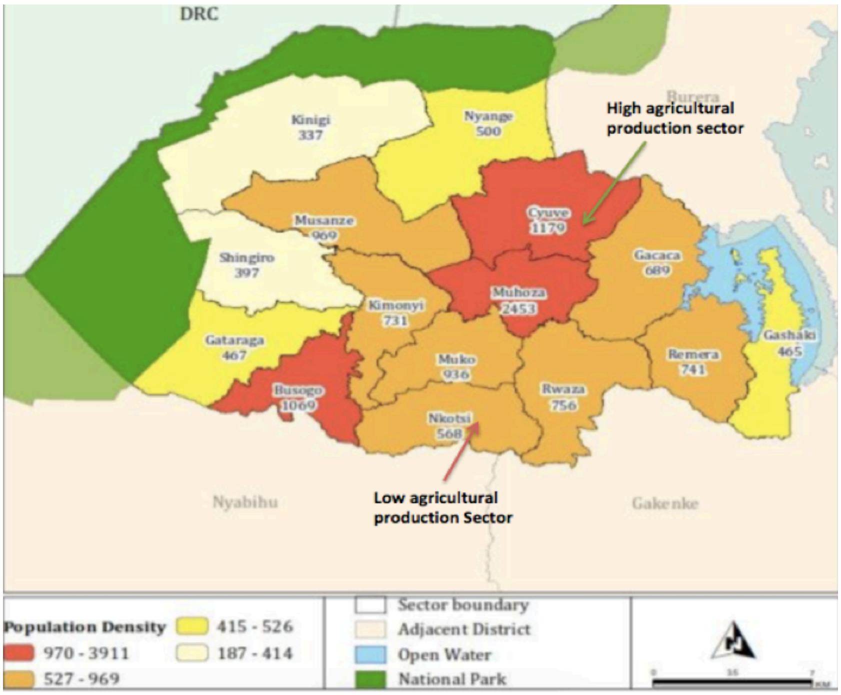
Source: Authors Own

Musanze District

Musanze district is in the northern part of Rwanda, neighboring Uganda and the DRC. The district has 368,264 people with a population density of 690 people, the highest in the study (National Institute of Statistics of Rwanda 2015b). Cyuve, one of three most populated areas in the district, was selected as a high agricultural performing sector while Nkotsi, with half the population density, represented the low performing sectors in the district (Figure 4.10). About 28% of the population in Cyuve is urban whereas in Nkotsi sector most of the inhabitants are rural (National Institute of Statistics of Rwanda 2015b).

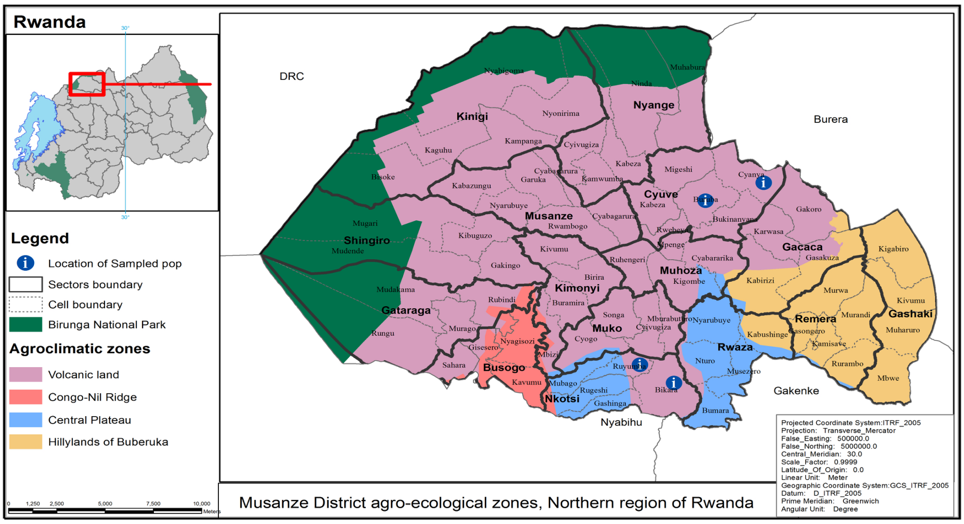
The selected sectors in Musanze district are in the Volcanic land agro-ecological zone (Figure 4.11). The zone is known for its volcanic fertile soils and regular well distributed rainfall, providing favorable conditions for agriculture (Verdoodt and Van Ranst 2003).

Figure 4.10: Location of the sampled sectors in Musanze



Source: Authors own

Figure 4.11: Agro ecological zones in Musanze



Source: Authors own

The characteristics of the districts selected in this study are summarised in Table 4.4.

Table 4.4: Study location and sample

District	**Sector**	**Ag. Performance Low /high**	**Ecological zone**	**Sample size**
Nyamagabe	Buruhukiro	High	Congo-Nil Ridge	36
	Gasaka	Low	Congo-Nil Ridge	36
Nyanza	Ntyazo	High	Central Plateau Mayaga Bugesera	36
	Rwabicuma	Low	Central Plataea	36
Gatsibo	Rugarama	High	Eastern Plateau	36
	Kageyo	Low	Eastern Plateau	36
Musanze	Cyuve	High	Volcanic land	36
	Nkosi	Low	Volcanic land	36
Total interviewed for the survey				288

Source: MINAGRI and districts

The extreme diversities between study areas shown in this section enable meaningful comparisons between farmers in different locations to be made, as will be discussed in chapters 4, 5, 6 and 7. Selection of the district and sectors was made in February 2017– with the help MINAGRI and Districts, as already mentioned. Respondents interviewed for this research come from 4 districts, 8 sectors, 18 cells and 37 villages. The next section explains the process of choosing farmers for the survey.

The Selection of Farmers

Unlike participants in the in-depth interviews and group discussions, survey participants were randomly selected. The target was to select 288 farmers: 72 from each of the four districts, made up of 36 from each of the two sectors categories (High and low agricultural performance). Since a list of all farmers was not easily available in each sector, a household[42] was randomly selected from any cell. Using the selected household as a reference, interviews were conducted following a specific geographic direction, with every 7th household in that general direction selected for interview until the required number of 36 was reached. Within the household, any one person knowledgeable about the agricultural activities of the household was suitable for the interview. In case of an absent respondent, the field assistant concerned made an appointment to return. In some cases an interviewer located the respondent in the field or at a trading center and made an appointment for a later interview. Table 4.5 shows the number of in-depth interviews from each group.

Table 4.5: Participants in the in-depth interviews

	Policy makers	MINAGRI	Donors	Private Sector	Local leaders	Agronomist	Farmer	Total
Kigali	4**	7*	3	3				17
District				2	3***	3	5	13

Note: Most MINAGRI staff work in districts too
* 3 of the people interviewed as MINAGRI staff no longer work at the Ministry
** Policy makers included ministers, Government advisors and African an Union official
*** Local leaders include a district Mayor who is also a policy maker

Parallel with the survey, I conducted in-depth interviews and group discussions. Most farmers to be interviewed were identified within the same district. Usually one in-depth interview led to another: for instance, if a farmer referred to a change agent in their village during an interview, I would locate the change agent and hear their story. The aim was to interview at least one farmer per district.

[42] A household is a group of people with common provision of food, shelter, and other essentials of living.

4.3.3 Research permit

Permission from the ministry of education is required prior to undertaking any research in Rwanda. The permit is issued after the researcher becomes affiliated with a Rwandan institution and acquires a local supervisor. Once a local supervisor was assigned, I started the application process for affiliation with the University of Rwanda. More than 8 months passed before the affiliation was granted; fortunately, affiliation with the University of Rwanda, College of Agriculture and Animal Sciences and Veterinary medicine was granted, and my research approval was granted, allowing me to collect data as scheduled (Annex 3).

4.4 Data collection and analysis

It was critical that the open-ended questions in the in-depth interviews and group discussions corresponded with those in the structured questionnaire, in order to generate information that could be integrated to respond to the research question. Therefore, a significant amount of time was spent carefully analyzing the questionnaire in order to remove ambiguity and ensure alignment with the research question. Some modifications to the questionnaire were made after insights were gained from the in-depth interviews before and after translation. Translation was undertaken by a friend, and checked during field assistants' training in preparation for the survey.

I employed three research assistants with similar experience to conduct the survey. Since they had prior knowledge of conducting agricultural surveys, they were instrumental in revising and checking the translation of the questionnaire. This was done during both a one-day training session in Kigali in February 2017 and another day of questionnaire piloting in Musanze district.

During the pilot, it was noted that the open-ended questions tended to take time. Therefore, I spent time refining the questions and reducing the scope of the questionnaire. The aim was to cut back the time spent administering the survey from the 3 hours reported in the pilot to 2 hours. Reducing the duration of each interview was essential since household members already have many responsibilities, limiting their free time. In some instances interviews were conducted while the participant was working (Figure 3.14). For example, in Musanze I sat next to Petronella and interviewed her while she continued to sort her maize harvest.

Strategies to shorten the interview included removing or spreading out the open-ended questions. Questions asking about problems encountered were avoided at the beginning of the questionnaire, but incorporated in different sections.

Once the team was confident in the format of the questionnaire, the survey was commenced in March 2017 in Musanze District. Although we had reviewed the questionnaire, there was still a possibility of misinterpreting questions and making mistakes, especially at the beginning of the survey. Therefore, I encouraged constant feedback during the day after each interview. In the evening brief meetings were arranged to discuss any difficulties encountered during the day.

4.4.1 Data analysis and integrating findings

As explained in the earlier sections of this chapter, the mixed method approach was selected as the most appropriate method for this research. It was apparent that using the mixed method approach would be time-consuming and complex from fieldwork preparation; data collection, entry, and analysis; and the reporting of findings. Data analysis was particularly complex since data was collected using various methods.

Subsequent to data collection was data translation and transcribing the recorded interviews. Numerical data was then entered into excel spreadsheets. Open-ended questions in the questionnaire were coded to organize responses so that data could be entered into spreadsheets and analyzed in a structured way. Answers were categorized and coded to allow quantification and analysis. Having structured and unstructured responses made data processing particularly complex. I therefore use varied techniques such as descriptive statistics, cross tabulation, t-test and logistic regression using SPSS to analyse the data and respond to the research question.

Descriptive statistics includes computation of averages, frequencies and percentages. For example, using percentages was a good way of showing the proportion of the farmers that grow certain types of groups, use new technologies, and increased productivity. However this method does not explain the rationale behind the different choices.

Cross tabulation was used to find the association between categorical variables. For instance, it was used to find out whether there was any association between gender and membership to a farmers' organisation. In case of continuous variables a t-test was used to compare means between two groups e.g finding out if there was a significant difference in land size between farmers in sector category 1 and 2. To understand the trends and direction of the relationship between variables, logistic regression was used.

Logistic regression was applied as an appropriate tool used to investigate how different variables affect the occurrence of a binary outcome (Long and Freese 2001). Based on similar studies, the logistic regression was used to identify factors that affect a specific outcome(Wang et al. 2017, Deressa et al. 2009, Schmidt and Strauss 1975). In this study, a logistic model was used to identify socioeconomic and institutional factors that affect farmers' choice to adopt improved seeds and chemical fertilizers; factors that affect productivity and commercialisation. The next section presents a generalized model, which will be modified in chapter 6 7and 8 when analysing factors that affect technology adoption, productivity, and commercialisation respectively.

4.4.2 Factors affecting technology adoption, productivity, and commercialisation

The adoption of new technologies by smallholder farmers is influenced by several factors (Mwangi and Kariuki 2015). These include, household demographic characteristics, socioeconomic and, institutional factors. A logistic model was developed to analyse the adoption behavior of farmers to improved seeds and fertilizers.

$$\text{Ln}\,[P_i\,/\,(1-P_i)] = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \ldots\ldots\ldots + \beta_k X_{ki}$$

where the subscript i means the ith observation in the sample. P is the probability that a farmer adopts improved seed and chemical fertilizers (1-P) is the probability that a farmer does not adopt the inputs. β_0 is the intercept term and β_1, β_2,.........., β_k are the coefficients of the independent variables X_1, X_2,.........., X_k.

The dependent variables is measured by a dichotomous variable: Adopters: farmers who used and still use improved seeds and chemical fertilizers while those not using these inputs were not adopters. The probability to adopt or not to adopt is explained by social and economic factors in Table 4.6. Results of Logistic regression analysis showing factors that affect the adoption of improved seeds and fertilizers are discussed in chapter 6

Table 4.6: Description of independent variables that affect technology adoption

	Independent variable	**Description**	**Unity**	**Expected sign**
X_1	Age	Farmer's age in years	Continuous variable	+/-
X_2	Gender	Whether male or female	1 if male, 2 if female	

X_3	Household size	Number of people in the household	Continuous variable	+
X_4	Education	Education status of the farmer	1 if formally educated, 0 if illiterate	+
X_5	Land size (ha)	Size of land owned	Continuous	+/-
X_6	Number of assets	The number of assets owned	Continuous	+
X_7	Number of plots	The number of plots owned	Continuous	+/-
X_8	Maize grower	If farmer grows maize	1 if maize grower, 0 if not	+
X_9	Access to extension services	If a farmer was visited by an agronomist in 2016	1 if visited by an extension agent, 0 if not	+
X_{10}	Access to market	If farmers have sold produce in 2016	1 if farmers sold produce in 2016, 0 if not	+
X_{11}	Income from sales	Income earned from crop sales in 2016	Continuous	+
X_{12}	Access to credit	If farmers has access to credit	1 if farmer has access to credit, 0 if not	+
X_{13}	Membership of a cooperative	Membership of a farming cooperative	1 if a member of a cooperative, 0 if not	+
X_{14}	Time to the district sector	Time taken to travel to the sector in minutes	Continuous	-
X_{15}	Sector category	Whether a farmer belongs to category 1 sector, or category 2	1 for category 1, 0 for category 2	+

Note: A positive correlation indicates that as one variable increases, so does the other. A negative correlation indicates that as one variable increases, the other one decrease.

Factors affecting increased productivity

A similar analysis was conducted to identify factors that influence increased productivity**.** A logistics regression model was formulated to determine the probability of a farmers increasing yield. The dependant variable is binary, with 1 if a farmer says they increased yield and 0 if they did not. A logistic model was used to explore the strength of the relationship of various social economic, technological, and institutional independent variables with increasing productivity (dependant variable):

$$Ln\ [P_i\ /\ (1-P_i)] = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \ldots\ldots\ldots + \beta_k X_{ki}$$

where the subscript i means the ith observation in the sample. P is the probability that a farmer improves productivity (1-P) is the probability that a farmer does not. β_0 is the intercept term and β_1, β_2,.........., β_k are the coefficients of the independent variables X_1, X_2,.........., X_k.

The independent variables are summarised in Table 4.7 and results of the logistic regression analysing factors that affect farmers' ability to increase yield are discussed in chapter 7.

Table 4.7: Description of the independent variables linked to productivity

	Independent variable	Description	Unit	Expected sign
X_1	Average Age	Average age of a farmer	Continuous	+/-
	Gender	Whether male or female	1 if male, 2 if female	+
X_2	Household size	Number of people in a farmers' household	Continuous	+
X_3	Education	Farmer has formal education	1 if educated, 0 if illiterate	+
X_4	No of plots	Number of plots owned	Continuous	+/-

X_5	Land size	Size of land owned	Continuous	+/-
X_6	Use improved seeds and fertilizers	Use of improved seeds and fertilizers	1 if farmer applies these inputs, 0 if not	+
X_7	Use manure	Use of cow manure	1 if farmer uses manure, 0 if not	+
X_8	Planting in rows	Uses the technique of planting seeds in row.	1 if farmer plants seeds in rows, 0 if not	+
X_9	Monocropping	Farmers uses the technique of monocropping	1 if farmer uses monocropping, 0 if not	+
X_{10}	Cooperative	If the farmers is a member of a cooperative	1 if a member of a cooperative, 0 if not	+
X_{11}	Extension services	Farmers accesses extension services	1 if visited by an extension agent, 0 if not	+
	No of assets	The number of assets a farmer owns	Continuous	+
X_{12}	Access to market	If farmers have sold produce in 2016	1 if farmers sold produce in 2016, 0 if not	+
X_{13}	Protected	Land protection from soil erosion	1 if farmer uses any land protection techniques, 0 if not	+

Note: A positive correlation indicates that as one variable increases, so does the other. A negative correlation indicates that as one variable increases, the other one decrease.

Similarly, a logistic model was used to explore the strength of the relationship of various social economic, technological, and institutional independent variables with participation into produce markets (dependant variable):

Table 4.8: Description of the independent variables related to commercialisation

Note: A positive correlation indicates that as one variable increases, so does the other. A

	Independent variable	Description	Measurement	Expected sign
X_1	Average age	Respondent age in years	Continuous variable	+/-
X_2	Gender	Whether a respondent is male or female	1 if male, 2 if female	+/-
X_3	Distance to the market	Time taken to the market (minutes)	Continuous	-
X_4	Distance to the trading centre	Time to the trading centre (minutes)	Continuous	-
X_5	Average land size (ha)	Size of land owned	Continuous	+
X_6	Access to extension services	If a farmer has access to extension services	1 if visited by an extension agent, 0 if not	+
X_7	Use of improved seeds and fertilizers	If farmer uses improved seeds and fertilizers	1 if a farmers uses improved inputs, 0 if not	
X_9	Increased yield	If the farmers increased yield	1 if farmer increased yield, 0 if not	+
X_{10}	Membership to a farmers' organisation	Membership to farmers' organisation	1 if farmer belongs to a farmers association, 0 if not	+
X_{11}	Membership of a cooperative	Membership of a farming cooperative	1 if a farmers is a member of a cooperative, 0 if not	+
X_{12}	Membership to a SACCO	1 if farmers belongs to a Sacco and o of not	1 if a farmers belongs to a SACCO, 0 if not	+
X_{13}	Phone	If a farmers owns a mobile phone	1 if a farmers owns a phone and 0 if not.	+

negative correlation indicates that as one variable increases, the other one decrease.

A set of variables defined in Tables 4.6, 4.7 and 4.8 contain both continuous and binary predictors. The variables were selected based on previous research and purposefully beginning with unvariate analysis of each variable (Bursac et al. 2008). Any variable having a significant univariate test at some arbitrary level is selected as a candidate for the multivariate analysis.

The different strands of data collected from the three data sources (interviews, group discussions and survey) were synthesized, integrating the narrative from qualitative data with the quantitative numerical data. Quotes from the qualitative data were compared and contrasted with the analytical data from the survey. The challenge was to decide the degree to which qualitative and qualitative interviews would be used during reporting. However, the important thing was to ensure that both the qualitative and quantitative data was well integrated to address the research question.

Other data sources used for this study included key government reports, studies, case studies and strategic documents (see Chapter 1). Household data from the institute of statistics from agriculture surveys, FAO/WFP-related agricultural data, and partners' datasets including USAID and World Bank were consulted, and project data and MINAGRI annual crop assessment reports were used.

4.5 Evaluating the limitation of the research design

Like any study, there are limiting factors in the research design that should be taken into consideration. It is important to reiterate that the aim of the research is to study the drivers of agricultural change in Rwanda during the period between 2000 and 2015. The richness of the data collected from experiences of policy makers and farmers histories provides insight and understanding of the different aspects of agricultural change for rural smallholder farmers. Nevertheless, there are some limitations that are taken into considerations. These include researchers' participant's error positionality, researchers' bias, participants' bias and selection bias.

Participant's error

Some of the open-ended questions asked farmers to reflect on the last 15 years and to highlight significant changes in farming systems during the period, if any. Other recall questions involved thinking about when and why a particular technology was adopted. This required respondents to reflect on matters that had occurred in the past. Knowing that people's ability to remember details of past events may be constrained, farmers were encouraged to anchor their responses to historical events. For example, some farmers said they had started using improved seed around the time of the last presidential elections, which pointed to the period around 2010. Additionally, information received through interviews was validated through other interviews or documentation

Positionality

Corlett and Marvin (2019) highlight ways in which the researchers' positionality, identity, role, and power could influence the research process and the knowledge generated. As a former government official, it was essential to reflect on how my previous position of power could influence this research. I was conscious of the fact that my previous involvement with MINAGRI presented both advantages and disadvantages. While I enjoyed the benefits of being local, understanding the people, language and terminologies, I was aware of the potential biases, especially with people with whom I had previously worked.

On one occasion while interviewing a former colleague, I noticed some slight awkwardness, the interviewee jokingly said, "Why are you asking me questions whose answers you already know?" In my reply, I reiterated that the research was opportunity to look back and reflect on personal experiences during the agricultural development process and document lessons learned. Despite the explanations, I was aware that people could tailor responses to what they think I am looking for.

Having worked with communities in Gatsibo and Nyanza districts for more than 4 years, the likelihood of interviewing a local leader, service provider or farmer with whom I had previously worked was high. I wondered how honest farmers would be commenting on programs I had headed, particularly if there was negative feedback. With that in mind, I decided not to participate in the survey but to conduct qualitative interviews instead. I suspected that since interview involve more in-depth discussions, it would be easier to identify misconceptions about the research.

The research assistants and I encouraged participants to look at the interviews as a storytelling exercise, done to facilitate knowledge sharing and learning. I found that knowing that the interview was somehow going to contribute to Rwanda's story motivated participants to engage in genuine conversation. However, it is possible that some responses may have been biased depending on how participants judged my intentions. While my positionality inevitably creates bias, it would not have been possible to reach many respondents if it was not for my background.

Research bias

From the very beginning of the research project the plan was to minimize sources of bias to ensure validity of the research findings. It was reasonable to expect that my own background as a MINAGRI employer and subjectivity might have a bearing on participant’s responses and data interpretation respectively. Conversely, given that the research relies on information from policy makers and farmers in country where good performance is upheld and a number social and economic interventions, it is important to consider participant bias. In such scenario, it is inevitable that some of the participants’ response will be influenced by what they think the researcher desires, which could subsequently have an impact on research finding. The important thing was to remain objective and mindful of the different biases.

To reduce biases originating from the participants' side, I explained the objectives of the research at the beginning to ensure that every individual had adequate information before participation. Having worked in the sector for a long time, I was in many cases able to gauge whether more information was needed or not. On two separate occasions, I was able to detect that farmers' were being dishonest.

The first incident was during an individual interview where a farmer said she was too poor to afford a cow for milk. Shortly after that, a cow mooed in the backyard. The farmer then reluctantly said, "oh yes, that is my cow". She then added, "I thought this study was recording vulnerable people for government support. I didn't want to miss out."

The second incident was a group of Nyamagabe farmers that assumed the study was about the Crop Intensification Program (CIP). As soon as the discussions commenced, farmers started to complain about CIP, saying it had been detrimental to their livelihoods. They shared how focusing on maize was causing hunger for most people in the village. Having visited most of the village that morning, I had noticed there was hardly any maize growing in the area. But I remembered March was a short rainy season where farmers plant beans. As the complaints persisted, I thought these farmers must have grown maize in the last season instead. I then asked if anyone had grown maize during the last season. It became apparent that in fact, none of the farmers in the groups had planted maize that year. They then confessed that they were unsure of the aim of the research and suspected it was about engaging in CIP. After that was cleared up and I had to explain the purpose of the research again, they then said, "Now that we know you are a student, forget what we said earlier, and let us start again."

These interesting encounters show that research participants can intentionally give false responses. Indeed, people have all sorts of motivations for not telling the truth (Mazar and, Ariely 2015). In some cases participants may anticipate associated benefit, the case of the woman with the cow. Dishonesty may be increased in situations where the consequences of one's action are less direct e.g farmers in Nyamagabe. In Rwanda, where the poor depend on social safety nets provided by government and economic performance is closely monitored, some level of participant bias can be expected. While researchers are focused on obtaining data that best respond to their research questions, respondents may want to give information on their own terms for their own benefit.

Responses from farmers could have also been influenced by the rough conditions caused by drought. In 2016, farmers, particularly those in Gatsibo and Nyanza, experienced drought, and by the time I carried out the research in 2017, some farmers were still dealing with the after-effects. Having recently had poor harvests and experienced hunger, people in these areas were likely to be pessimistic about life. I noted that, irrespective of the drought, in poor performing areas farmers tended to overstate failure to attract government support, while in better performing areas they were more likely to exaggerate their success for recognition.

Selection Bias
There is potential selection bias from using the Snowballing method especially since people tend to recommend contacts of participants that share similar views. One of criticism of snowballing is that it does not ensure sample diversity (Kirchherr 2018). To address this problem, I started with a diverse group of people at each level. For example at the district level, I interviewed local leaders, agrodealers, agronomists, and farmers whose contacts I had retained from prior connections. Drawing from the different conversation, I was able to build a diverse snowballing sample of people who had been involved in agricultural change especially during the initial stages of the reforms.

4.6 Summary

This research uses a mixed method approach to gather information about agricultural change in Rwanda from a number of respondents. Information about changes that occurred, personal experiences and contributions from participants was collected at the national, district, sector and farmers levels. To select a representative sample, purposive sampling, stratified random sampling and random sampling methods were used. The quantitative and qualitative data collected was triangulated to respond to the research questions. The richness of this methodology is demonstrated in the following data chapters.

Chapter 5 draws from the survey data, interview from policymakers, private sector and groups discussion to understand the process of agricultural prioritisation and policy development. The chapter also assesses the impact of the agricultural reforms on farmers.

Chapter 6 uses survey data and group discussions to understand the process of adopting new seeds and fertilizers and farmers' experience. The chapter also highlights factors that have been important for growth.

Chapter 7 investigates innovations and institutions for efficient land and water management and the effect on agricultural productivity. The chapter also identifies factors that have led to increased productivity among farmers.

Chapter 8 draws from all the data sources to examine the role of collective action in agricultural development. It surveys the different relations between farmers, state, donors, private sector and donors to understand the influence the on agricultural trajectory in Rwanda

Chapter 9 draws from all the four data chapters to summarize the conclusion of the study. It underlines the key finding of the research, implications on policy, and suggests areas of future research.

Chapter 5 The process and impact of the prioritisation of Smallholders

> *'But what choice does Rwanda have? To remain in the current state is simply unacceptable for the Rwanda people.' Concluding words of Rwanda's Vision 2020*

At the onset of the 21st century, one of the pressing issues for Rwanda's leadership was to reboot the economy that had been crippled by decades of ethnic division, conflict, and the 1994 genocide against the Tutsi. At the time, millions of Rwandans faced severe hunger and poverty. As discussed in Chapter 2, the need to address these issues and advance economic growth brought the agricultural sector to the fore. Agriculture reforms after 2000 aimed to transform the weak agricultural sector into a much more vibrant and inclusive sector, relevant to economic growth and poverty elevation. Drawing from the experiences of policy makers, this chapter gives insight into the processes of smallholder prioritisation, problem diagnosis, policymaking and the mechanisms of policy implementation. Using the farmers' voices and a snapshot of national production data, the chapter also examines the effect of policy on food production and farmers.

The chapter is divided into 3 sections: section 5.1 explores the process whereby smallholder agriculture is prioritised, and how policy development and implementation are undertaken. Section 5.2 lists the demographic characteristics of survey respondents, to contextualise their voices and experiences; the section highlights changes that have occurred in agriculture since 2000 from policy makers and farmers perspectives; uses data from the survey and MINAGRI to show changes in food production, productivity, and commercialisation at the national and district level order to analyse the impact, Section 5.3 gauges the impact of the new reforms by asking farmers their view on life today compared to 2000.

5.1 The prioritisation of smallholder agriculture

Given the limited resources, Rwanda's challenge after the 1994 genocide was the prioritisation and sequencing of the different political, social and economic policies. It was important to have a framework through which policy makers could better navigate the complexities of forming appropriate policies. The government's immediate focus after the genocide was national rehabilitation, reconstruction, security and reconciliation. Reconciliation was particularly crucial in forging a new sense of national identity. The nation was still fragile after genocide, which had destroyed trust within the communities. Rwandans needed stability and to feel safe before they could embark on investing in any economic activities like agriculture. As a high-level official in MINAGRI revealed there was great uncertainty around farming in the early years after the genocide:

> Like in other sectors, people invest in agriculture because they feel safe and secure. There is a time in Rwanda when people did not feel safe. (…) The genocide tremor was fresh in people's minds and they feared it would happen again. (…) In such a scenario, people do not put much effort into anything because they are not sure about tomorrow. When they farm, they do not know whether they will be there for the harvest. When they buy livestock they are not certain they will have it tomorrow. What I am saying here is that security and peace of mind is a strong foundation for investment of money or energy in anything one believes could be beneficial.[43]

By the end of the 1990s, the country was in a position to focus on social and economic development. The process that started in 1998, was kicked off by the 'urugwiro' ('hospitality' in Kinyarwanda) dialogue that was part of a national consultative process around the following questions:

> How do Rwandans envisage their future? What kind of society do they want to become? How can they construct a united and inclusive

[43] Interview with MB.

> Rwandan identity? What are the transformations needed to emerge from a deeply unsatisfactory social and economic situation?[44]

Urugwiro discussions, that were led by the government, stirred people to analyse Rwanda's problems and contemplate ways in which positive economic and social changes could be attained. This was not a process that included only politicians and policy makers; discussions included scholars, community representatives and Rwandans from different organisations. For instance, some of the people interviewed during this research participated in discussions as policy makers, scholars, private sector representatives, and members of the local community or politicians. One of the participants who is a politician described the urugwiro national dialogue as a search for a shared vision:

> We had discussions at many levels; remember we took a whole year having meeting at Urugwiro discussing the problems of Rwanda (…). We wanted a shared vision; we would consult with grassroots people and then report back to Kigali. … Since people had different views [about challenges and opportunities of Rwanda], we continued discussions until we reached consensus.[45]

The urugwiro dialogue went on for almost two years allowing time for back and forth flow of information among the political actors, policy makers, and citizens. This process aimed to shed light on issues on the ground, in order to articulate the appropriate social and economic transformation needed and determine Rwanda's long-term vision. A scholar who participated in the Urugwiro discussion before becoming a government official revealed that:

> When Rwanda was designing the Vision 2020 a lot of people did not think that agriculture would come at the forefront as one of the important pillars of the economic development. (….) But during the planning process [urugwiro dialogue] people come to the realisation

---

[44] Rwanda Vision 2020.
[45] Interview with MM.

> that anything that would effectively drive the economic process in Rwanda would have to take agriculture into consideration.[46]

Having been a non-vibrant sector, agriculture was initially not considered as an obvious driver for economic development. But as explained by a district mayor, there were a number of reasons why focusing on agriculture was important:

> As a country, we had many people in poverty and with limited resources. We decided that what was needed was to revamp the agricultural sector, since most poor people were skilled in farming and owned land as their primary resource.[47]

The notion of endorsing agriculture as a core driver of economic development was reinforced by the results from poverty studies. A participatory poverty assessment conducted in 1996 highlighted that households in poverty were those facing challenges such as: land tenure insecurity, lack of shelter, lack of agricultural inputs, food insecurity, long distance to markets, limited or no livestock ownership and poor access to primary education (GoR 2000a). The report also showed that the primary source of income for rural dwellers was agriculture. From this assessment it was clear that improving agriculture would address issues related to poverty. In addition, as remarked by a high-level official in MINAGRI, agriculture was to be relied on as major contributor to GDP:

> The government started thinking of the type of investments that would be needed to make agriculture an economically viable activity or part of the life of Rwanda that was contributing significantly to GDP.[48]

Given the perceived potential of agriculture to increase food and rural income, it was rational to earmark agriculture as one of the key pillars of poverty reduction and economic development. This was underscored in both the Vision 2020 launched in 2000 (GoR 2000) and the Poverty Reduction Strategy

---

[46] Interview with MA.
[47] Interview with DMG.
[48] Interview with MAK.

(GoR 2002b). Whilst the development of the Vision 2020 and Poverty analysis were mostly led by the government, as highlighted by a MINAGRI official, they were well aligned with policies promoted by international donors:

> I will say the World Bank guided the philosophy around PRSPs at that time (….).[49] Rwanda like many other countries was putting in place Poverty Reduction Strategic Plans (PRSPs).

While designing the new approaches policy makers were motivated by the fact that other countries like Malawi that had followed a similar pathway were achieving considerable success.

> I was on the team that visited Malawi with the President in the early 2000s. I remember President Kagame saying, look at this country [Malawi], it was food deficient and now it is an exporter of food, what did Malawi do that we cannot do in Rwanda? (…) I become a chair of a committee charged with understanding what could be done in our own context to support farmers and improve food production.

Similar to Rwanda, agriculture in Malawi is dominated by smallholder farmers. It was recognised that for agriculture to make a tangible contribute to Rwanda's economic transformation, the government had to pay attention to smallholder food producers.

Vision 2020 was a unique and unprecedented process centred on a dialogue between politicians, and practitioners of development, community representatives and other Rwandans from different settings. Similar to experiences in other African countries, this chapter discloses initial scepticisms among policy makers about the potential of smallholder agriculture to drive economic growth.[50] After a 2 year long deliberation on which sectors would be most appropriate for growth, agriculture was presented as one of the core drivers of economic development and poverty reduction. This decision was a result of debates and ideas from different actors and was informed by various academic studies and experiences from

---

[49] Interview with MIE.
[50] See African policy on Smallholder farmers in chapter 3 section 1

other countries. Following prioritisation, agriculture became a more widespread issue of advocacy for action in order to reduce poverty and improve economic growth. However, in order to design appropriate agricultural policies, it was important to understand the underlying issues at the farm level.

5.1.1 Understanding farmers' challenges and designing policy

Although agriculture has always been an important sector in Rwanda, as one donor commented, the sector performed poorly before the reforms:

> It was obvious that Rwanda's agriculture was non-productive, and mostly subsistence. Therefore, the goal was to move to more market orientated agricultural practices with the idea that farmers would benefit the most'.[51]

Practitioners and the staff at MINAGRI understood that a thorough assessment of the agricultural sector was needed in order to formulate suitable policies and change the status quo. A staff shared the thinking at MINAGRI at the time:

> You cannot develop a new policy unless you understand the weaknesses and the challenges [to which the policy will be directed]. (…) We [MINAGRI] had to sit and agree that agricultural productivity was not improving. What were the reasons? What challenges did farmers have? Which policies could be put in place to support farmers? (…) We knew that solutions might not necessarily come from within the agricultural sector; they may come from other sectors in government.[52]

MINAGRI and the local government begun to discuss what needed to be done. In order to create ownership, a MINAGRI official said that, Districts

---

[51] Interview with DUSF.
[52] Interview MIJ.

Agricultural Development Plans (DADP) became an integral part of the policy making process:

> We [MINAGRI] conducted a participatory assessment to make sure that we captured the right priorities. We actually had districts formulate agricultural plans, which were compiled into one plan (…) the District Development Plans (DDP). The chapters in the DDP informed the agricultural strategy at the national level. This participatory approach was key in creating ownership and evidence-based policy formulation. That means we were formulating policies based on farmer's needs not from what we [MINAGRI] desired.[53]

At the district level, prioritisation takes a specific sequence to enable grassroots participation. The prioritisation and planning process at different administration levels[54] was described by a district Mayor:

> We start at village level (…) a village leader sits with his people and they come up with key priorities that would lead to the quick development of their Village. They send that to the Cell (….) then it moves from the Cell to the Sector. (…) At each level the priorities are reviewed and consolidated (….). The district level considers priorities from different sectors; (…) once we agree on priorities we submit them at the national level. At this level [the Ministries] they think macro (….) but grassroots views are given great consideration especially when it comes to agriculture.[55]

At the grassroots famers inform policies by highlighting their key challenges or sharing solution. For instance, a farmer from Nyamagabe district said their biggest challenge was soil acidity and infertility:

> In our village many people often migrated to other districts to look for work and food. Our village was known for hunger because our land is

53I Interview MIE.

54 See details of local government structure Chapter 2, Section 2

55 Interview DMG.

> acidic and it has very low productivity. We often used manure to increase productivity but some of us did not have livestock.[56]

Like farmers Nyamagabe most of the respondents interviewed highlighted low land productivity as one of the biggest challenge in farming. But as revealed by the officials in charge of policy development at the time, the challenges at the farm level were many and prioritisation had to be done:

> A number of areas needed attention. It was then that infrastructure development was thought through. Rwanda's infrastructure development in agriculture involved marshland rehabilitation and irrigation. (…) The other was facilitating access to inputs so that farmers could produce more.[57]

> In the agricultural sector everything was a priority, for example we needed to have improved seeds. (…) You see, the Rwandan environment is favourable for a variety of crops therefore farmers grow many crops. What we decided was to focus on a few priority crops. The crops prioritised were those that had high impact on food security, high value addition potential, and the possibility of creating local jobs. It was also important to prioritise crops that respond positively to the use of inputs like chemical fertilizers.[58]

> We [the government] recognised that if we continue promoting agriculture with the existing land tenure system it would not work. But we also realised that a single sector could not do the required land reform alone, other players had to be involved. (…) The land use consolidation was successful only because the land registration and the land titling process were going on through the ministry of Nature Resources. Otherwise consolidating land for agricultural production would not have been possible if the land title was not there and if the

56 Interview FNYG

57 Interview MAK.

58 Interview MIE.

> farmers were not guaranteed that they would still keep their land rights on their small plot.[59]

All the challenges underlined in the narratives above have been highlighted in previous studies that analyse key challenges among farmers in Rwanda see for example Kelly and Murekezi (2000); Clay (1998), GoR (2000b) and by respondents in this research. The government embarked on policy formulation in response to the problems at the farm level and future goals of the sector. Firstly, MINAGRI developed a new policy, which according to one official was the first broad policy for agriculture:

> The first step was to develop a strong consolidated agriculture policy; I will not say that we had a strong agricultural policy before. We had some thematic policies but there had never been a consolidated agriculture policy. Our first consolidated agricultural policy was completed in 2004 (…) the policy was in line with the Vision 2020 and with the PRSP…. The policy was then used to frame and formulate the first Agricultural Transformation Strategy (PSTA 1).[60]

The National Agricultural Policy (NAP) and PSTA 1, finalised in 2004, became key reference documents for the agricultural transformation process. The aim of these documents was to introduce radical changes in the sector by facilitating the move away from subsistence to more market oriented farming.[61] A former MINAGRI official explained that, to achieve the desired outcomes, policy and strategic documents had to be operationalized through the development of specific and implementable programs:

> In 2004, we completed our national policy, which was just a document. So if you look at it, it is not something you can start to implement, it is a framework that gives guidelines. So we had to sit and from the policy design a strategy, which is the PSTA. PSTA is also not something that one can start implementing since it is not an implementation manual.

---

[59] Interview with MIJ.
[60] Interview with MIE.
[61] NAP and PSTA are discussed in Chapter 2, Section 2.

> So we had to review each pillar of the PSTA and design implementable programs. (…) Programs have to be focused with specific targets and activities to attract funding.[62]

One of the most significant policies/programs for agriculture as highlighted by all policymakers was the CIP.[63] Discussions with policy makers indicate that agricultural programs and policies are designed using a two-way approach; bottom up and top down as MINAGRI officials explained:

> When I participated in the design of an International Fund for Agricultural Development (IFAD) funded projects, our team talked to farmers and worked towards the realisation of their dreams. Their dreams included increasing food and having better livelihoods.[64]

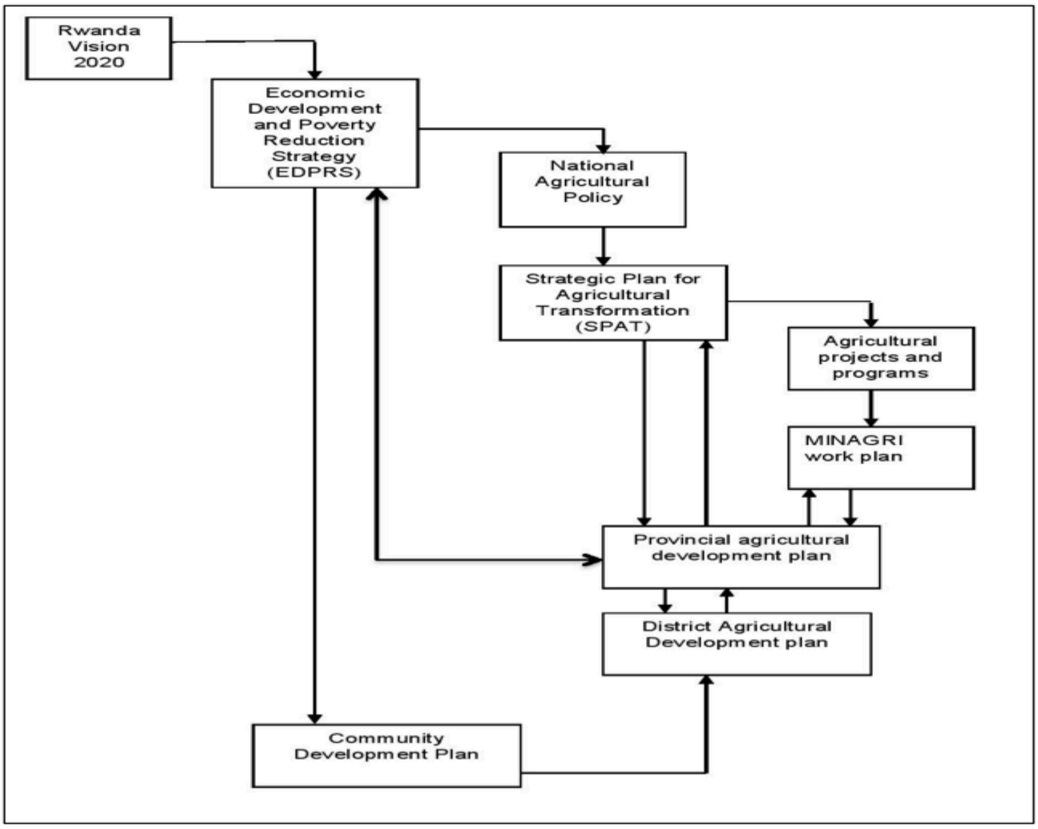
> We had to go and test the acceptability of a policy by the people. (…) When there is an idea through scientific assessment, it has to be tested first. Therefore, to get a policy accepted at the national level, one has to go back to the bottom side [farmers]. For example when a policy is about land, we know that land belongs to smallholder farmers. So we have to go back and get farmers understanding and owning the new policy.[65]

In each approach, the fundamental requirement is that local communities understand the policies that affect them and to some extent participate in the formulation process. Figure 5.1 displays the top down and bottom up planning and policy framework for agriculture transformation.

---

[62] Interview with MIJ.
[63] See Chapters 2 and 6 for further discussion on CIP.
[64] Interview with MIS.
[65] Interview with MIJ.

Figure 5.1: Planning and policy framework for agriculture



Source: MINAGRI PSTA1 2004

As already shown the policy design and planning involves a number of stakeholders.[66] However, government is deliberate about build consensus among different partners. As described by a senior government official, efforts are made to get key players on board particularly donors:

> Within the agricultural sector the ministry has an opportunity to defend the different policies. (…) More importantly, we designed a mechanism of engaging donors from the time polices are being designed. We also engaged the other partners besides donors including other ministries, private sector and farmers representatives.[67]

---

[66] Chapter 8 discusses stakeholder interaction and collective action.
[67] Interview with MAK.

One important requirement was that donor-funded projects be aligned with the national policies:

> Once programs are developed and aligned with the national development framework and everything was set, the next thing becomes to implement the program and facilitate the needed changes at the grassroots.[68]

Designing policy was only the beginning, policy makers had to be responsive in order to address issues as they arose during implementation. As shared by a MINAGRI staff policy making was a dynamic policy.

> For example, the rice policy had to be instituted because there was a thrust in the rice production and it became necessary to develop a specific policy for the sector. (…) The fertilizer policy was also developed in order provide guidance for increased fertilizer trade.[69] We have to be aware of the changing environment and respond accordingly.

As would be expected, the try and error approach means that in some cases policies fail. A government official narrated the failure of a goat distribution project:

> To increase soil fertility through manure and support poor families to raise income, farmers were given goats to rare. This was around 2003 or 2004, along the way the goat strategy was not as beneficial as we envisioned because we found that people had eaten all the goats. We had to go back to the drawing board and ask what do we do? (…) We decided to try giving cows to poor farmers. Cows are of high value, they provide daily nutrition, and the potential income as well addresses the problem of soil infertility when manure is applied to the land. It was anticipated that this would be a better livelihood project. That is how the One Cow per Poor family policy emerged.[70]

---

[68] Interview with MIJ.
[69]Interview with MIC.
[70] Interview with MMO

It is often tempting to see Rwanda's agricultural policy shifts as a result of single man, single policy, heavily top down decision making. As shown by this section, there were back and forth discussions between different key players before policies were endorsed. While policies aim to steer agriculture towards a direction where the sector has higher value and is more market oriented, the policies designed are a response to problems identified at the farmers' level. The trial and error approach serves as a way of capturing lessons learnt throughout the policy design and execution process. The nature of interactions between officials and the smallholders, as well as the subsequent consultations between officials within various ministries, closely resemble the features of 'embedded autonomy' set out by Evans (1995). It is indeed the case that this resemblance does not belie the difficulty faced by all actors, that while they agreed on a common principle of the need to have a strong policy, translating the written policy into action can be challenging. The next section examines the mechanism used to ensure effective policy execution in order to investigate how the agricultural policy of the Rwandan developmental state fared in the field.

5.1.2 Turning Written Policy into Actions: Tools for Policy Implementation

MINAGRI is responsible for agricultural transformation and the day-to-day implementation of the policy through different agencies, programs and projects. These entities work closely with different districts to jointly implement and deliver the programs. Policy implementers at the national and district level included MINAGRI staff, local leaders, technical staff (agronomists) and farmers' representatives. This section presents the strategies of policy makers while trying to design an effective implementation apparatus that would create change at the grassroots.

According to a former senior official at MINAGRI, 'having a program and even having funding is one thing, implementation [laughs] is a different story.'[71]

[71] Interview with MIJ.

Policies are only instruments that present options for action to create the desired changes. In spite of the fact that in the Rwandan case implementers were often part of policy discussions and formulation, execution was complex. As elaborated by a high-level official in MINAGRI at the time of the reforms, for a policy to work, political backing is paramount:

> In my opinion leadership is critical in creating the desired change. In spite of what other people may say or think the most important thing is that we have a good leader, president Paul Kagame. (..) Originally, the popular mind-set was that when people go into farming it was because they lacked other economic options. (…) It was important to have political backing at the highest level. So when our president would say, 'do whatever it takes, invest in agriculture because that is where most of our population is, the country cannot advance without farmers advancing,' that created a positive response towards agriculture from the top leadership and of course the minister of finance.[72]

A positive response from the President and the Minister of finance is what every ministry wishes for. The new tag on agriculture meant that financial requests from MINAGRI were given high-level political backing. Almost all the policymakers and implementers interviewed indicated that one of the biggest challenges during policy implementation was people and mind-set. A government advisor explained this by highlighting scepticism at the political and farmer level:

> I think the most difficult part of trying to advance agriculture was the mind-set of practitioners. In fact, this challenge was in both those practicing agriculture [farmers] and those supposed to help farmers improve their farming practices [implementers]. In agriculture there are a lot of conservative people, they want to farm their usual way (….). But I would say there are also non-loyal bureaucrats and when I say this I

[72] Interview with MB.

> am not saying loyalty to the government. I mean loyalty to the agricultural sector.[73]

People are general not open to change although this is not a Rwanda particularity. To get agriculture moving, it is critical that the agricultural agenda and approaches be understood and supported by the different key players, particularly the politicians and farmers. Political backing is important in building consensus at the different levels, and in the absence of this it impossible to ensure 'development coordination' (Dorward, 2009). This is particularly helpful because agricultural development goes beyond the Ministry of Agriculture. For instance, the Integrated Development Program (IDP) that brought together ministers from different ministries to analyse programs and point out their connectivity helped to improve alignment, coordination, and cooperation. A high-level government official explained how IDP works:

> We developed the Integrated Development Program (…) it had 11 ministers who reviewed a unified program; each minister would be responsible for a component in the program although in most cases they were integrated. I think this was useful. It was critical that efforts towards improving the country's economy are consolidated at all levels.[74]

Since ideas bounce back and forth from ministries to the IDP before and after cabinet meetings, this facilitated speedy approval of policies in cabinet, and encouraged integration program during implementation. One of the IDP members said they upheld the program because it was supportive during implementation:

> There was a mind-set change. Previously, it was not usual for a minister in another ministry to engage in agricultural activities, they would normally only attend to activities related to their own ministries. IDP created cooperative effort within cabinet members, which made

[73] Interview with MM.
[74] Interview with MM.

> implementation of agriculture programs easier. (…) Obviously, MINAGRI as the leading ministry was the driver and there was no other ministry suited to take the lead. However, MINAGRI would never have managed to engage ministers at this level, if the prime minister's office was not involved.[75]

Commenting on the IDP, a government official said that program helps to create consensus and the needed integration of ministerial programs:

> For me what was key was the fact that public investment to the sector was prioritised after the sector was judged 'important.' As such, political support resulted in the approval of several agricultural programs.[76]

For successful implementation, it is essential to have a strong and capable central government with the capacity to efficiently deliver programs. However, as revealed by a MINAGRI official, that was not the case:

> It is only when start implementing programs, that you notice the capacity gaps. (…) We agreed that if we tried to implement programs with the staff we had, we would make a lot of errors and not achieve the expected results. We had to first go back and assess our in-house capacity within MINAGRI and other players like the private sector. We then had to convince the leadership to outsource capacity to avoid implementation delays while pursuing in-house capacity building programs.[77]

With the aim of attaining agricultural transformation, an assessment of implementation capacity was essential to gauge the ability of different ministerial entities to execute programs. Different entities are given considerable autonomy but remain accountable to MINAGRI concerning performance standards. However, each member of staff in the ministry signs an annual performance contract, including the minister, and the performance of the ministry depends on how well everyone in the ministry does his or her

[75] Interview with MB.
[76] Interview with MA.
[77] Interview with MIJ.

job. Although ministers are not directly involved in the delivery of the programs, heads of agencies update them regularly. It is therefore in the interest of each staff to deliver the desired output and avoid sabotage. Accordingly, as elaborated by a MINAGRI official, it was important to have capable and committed staff:

> Commitment has its own importance. You may have the in-house capacity but not have their commitment. (…) You may have qualified staff but if they do not believe that things can change you will not achieve the desired result (…). I struggled with this in my institution. (..,) The first thing I did was to have a dialogue with staff and try and bring them all on board. (..) However, you have to get people to understand that they have to deliver and they have to be accountable and work against performance targets. If someone refuses to change and meet targets whether they have capacity or not there is no need to keep them.[78]

Effective monitoring of staff performance was essential at all levels in order to ensure that targets were met. Since Districts had become implementers of government programs after decentralisation, understanding their implementation structures became important.[79] However, as mentioned by one of the senior MINAGRI officials, the transition to the decentralised implementation system was challenging:

> Rwanda started decentralisation in 2006 where the local planning at the district level is very key (….) Decentralisation means that both capacity and finance are decentralised to the districts through this process. I remember when we started, there was initial resistance from different ministries. They transferred human resources but when it came to actual finances it was a struggle. But I think the leadership made a very good decision to make sure that the required human and financial resources were transferred to the districts. (…) However,

[78] Interview with MIJ.
[79] The decentralisation process is discussed in Chapter 2, Section 2.

> districts' decentralised staff had to be trained to improve planning and accountability systems.[80]

As highlighted in the above quote, effective devolution involved the release of resources to districts to enable program implementation. However, given the large structure of local government at the time, restructuring was necessary to facilitate efficiency and reduce implementation costs:

> Before 2004, we had more than 100 communes [districts, towns]. Reforms done around 2003 and 2004 reduced communes to 30 districts (….). What changed is that when the communes reduced to 30, administration costs also reduced. We concentrated on having a few but efficient people in local administration. [81]

In addition to structural changes in local government, staff capacity requirement also changed:

> We used to have local leaders most of whom had low education. Years back it was difficult to find a university graduate at the sector level. (…) To be able to implement government programs, the new appointed leadership had to have more capacity than the previous ones. For example, the district had to have at least seven university graduates (…). Even leadership at the cell had to have at least 6 years of primary school education. Before, this would not have been possible even at a sector level. (…) With education, people are expected to have more capacity to process and transfer information with improved speed and efficiency. Now, in addition to a more educated district leadership, we allocated technicians, an agronomist and a veterinary officer in each sector whose role is to support farmers.[82]

Transferring agronomists and veterinary agents from MINAGRI to operate within the decentralised structure, aimed to ease farmers' access to these services. Since the local government had become charged with all aspects of

---

[80] Interview with MIE.
[81] Interview with MB.
[82] Ibid.

rural development, therefore the local leaders were more involved in agriculture. It was assumed that local leaders with formal education, would be better suited to assess problems, provide the right environment for problem solving and facilitate implementation of different programs at the grassroots. The government put in place mechanisms to facilitate interaction between the different district structures and other implementing entities and track progress:

> There was very significant interest from the government both in terms of investing in the agricultural sector but also in terms of tracking progress so that where there are challenges, the government could design ways of coping. Where there was need for more investment the government adjusted accordingly. (…) There were mechanisms of tracking progress in the sector so that challenges and opportunities could be addressed in real time.[83]

As a donor stated, 'this means that government, public agencies, development partners, private sectors and farmers' systems needed to be well coordinated and well-functioning to be able to track agricultural progress."[84] Accountability among partners was also upheld:

> Everyone has to be accountable, even the non-government actors. When you bring in your support [technical or financial], you have to be accountable as well. (…) We have what we call a Common Performance Assessment framework (CPAF) that is managed by Ministry of Finance and Economic Development MINECOFIN. So in that assessment, if donors are aligned with government policies and provide support they also need to be accountable.[85]

In addition to consolidating and monitoring policy at the national level, the Ministry of Finance and Economic Development MINECOFIN, checks that different policies are aligned. Alignment of policies is done at many levels

---

[83] Interview with MAK.
[84] Interview with DUF.
[85] Interview with MIE.

including the district through Joint Action Forums (JAF) where different stakeholders agree on what needs to be done.

The broad agreement between all actors that there was a need to set up a strong agricultural policy in the wake of the genocide, offered a solid premise from which to start implementation. This section highlights that streamlining implementation structures, assessing capacity, and developing monitoring and accountability systems were important elements of policy design. Although other ministries are involved in the multiple aspects of the policy implementation, MINAGRI and MINALOC were charged with the actual execution and coordination of all agricultural activities. Performance contracts were part of accountability, where institutions and individuals were recognised for their performance. These performance contracts reduced the transactional costs of ensuring coordination, as it aligned the incentives of individual actors with successful roll-out of the implementation of the programme. The performance contracts also increased the motivation of people – particularly the local leaders – to define their own goals, and kept people focused on achieving them, which in turn improved coordination of actions. The different strategies for successful policy implementation were underpinned by strong political support and commitment. The commitment demonstrated by the top leadership facilitated buy-in and collective action of different actors as they all focused on improving conditions for farmers. The next section assesses the impact of these policies on farmers.

5.2 How smallholder farmers and policymakers explain changes in agriculture since the 2000 reforms

The aim of the policy reform in Rwanda was to facilitate increased productivity, commercialisation and better lives for farmers. The litmus test for assessing policy impact was to ask respondents to talk about changes they had experienced in their agricultural activities.

A diverse sample of 288 farmers participated in the survey. The average age of respondents was 46 years, which implies that most of the farmers interviewed would have had agricultural experiences before 2000 and were able to draw from personal experience of the impact of the post 2000 reforms. Table 5.1 shows the key socio-economic characteristics of farmers surveyed.

Most (63%) respondents were women probably because there are generally more women than men in Rwanda and in the district visited.[86] However, in the event that both husband and wife were found at home we found that women were keener to talk about agriculture. Thirty five percent of the women respondents were head of house household and most of them were widowed. About 61% of the respondents had formal education (mostly at the primary level), and more than half were able to read and write. While 80% of respondents depended on agriculture as their main source of livelihood, others relied on casual labour[87] and non-farm activities.

Table 5.1: The demographic characteristics of surveyed farmers

Variable	**Description**	**Number N=288 (%)**
Average Age (years)		46
Gender	Women (%)	182 (63)
	Men (%)	106 (37)
Average Household size		5
Formal education	Yes	175 (61)
Can read and write	Yes	158 (55)
Main occupation	Farming	242 (84)
	Labour	32 (11)
	Non farm	14 (5)

Source: Survey data

Drawing from these voices, these sections highlight changes that have occurred in smallholder agriculture in Rwanda since 2000.

[86] Generally there are more women than men in Rwanda. The proportion of women in the districts sampled was 52%.
[87] Casual labour is mostly on the farm.

A key question posed to all respondents was, '*What changes have you observed in agriculture during the last 15 years?*' About 84% of the respondents reported significant changes in agricultural systems since 2000. During a group discussion in Gatsibo district a farmer stated that the big change was that agronomists visited his plot:

> I had never seen an agronomist come to my home to give me advice on how to improve my farming. Today, agronomists come to my plot and advise on what can be done to improve cultivation and generate more crop yield.[88]

Table 5.2: Farmers' comparison of agriculture in 2016 and 2000

Around 2000	Around 2016
Mixed cropping, seed broadcasting, individualistic type of agricultural system with activities conducted at diverse times	Monocropping, planting in rows, often cooperative agricultural activities and coordinated planting
No use of improved seed or chemical fertilizers, occasional use of cow manure	Use of improved seed varieties and chemical fertilizers and frequent use of manure
Limited access to agronomist and advisory services	Improved access to agronomists and extension services
Limited engagement of local leaders with farmers	Increased local leadership involvement and influence in crop selection
Low land productivity	Increased yield and engagement in markets
Reliable weather patterns and predictable harvests	Unreliable rainfall and unpredictable harvests
Considerable soil productivity without use of fertilizers	Use of chemical fertilizers and manure is paramount to increase yield
No land use consolidation	Land use consolidation is encouraged

Source: surveys data

Note: Seed broadcasting is random is scattering of seed

Table 5.2 provides a snapshot of agriculture around 2000 and 2016 as described by farmers. It shows that in 15 years, technical, institutional and

[88] Group GKa

environmental changes had transformed the way agricultural activities were conducted.

Some of the characteristics mentioned by farmers were noticed by an agro-dealer who visited rural farms in the early years after 2000:

> A few things struck me at that time. Generally farmers practiced basic farming techniques. They used broadcast planting and things like proper spacing and planting in rows weren't relevant or weren't that observable. A lot of the farmers I spoke to had a little bit of an idea there could be better seeds, inputs and techniques out there but had little sense of where to get them or how to access them. There were a few coffee fertilizer initiatives at the time I remember and that was the only little source of inputs. I tried to find shops that had supply and there was limited supply and then if you looked at the high-level national numbers, there was like 3% of farmers using improved input on staple crops. Coffee and tea might have been different.[89]

The majority (55%) of the farmers stressed that use of improved seed and fertilizers was the most significant change that has occurred in agriculture. Considering that the use of new inputs also involved new farming methods, most farmers have adopted new techniques. For example, some farmers have shifted from multi cropping to monocropping to specialise in specific crops in each plot. Also, due to more sporadic weather patterns, and greater investment in agriculture, the timing of planting has become increasingly important to avoid losses and to maximize production. As farmers disclosed, these changes did not occur instinctively, but were influenced by the increased engagement of agronomists and local leaders:

> Before, we mixed many crops in one plot; we planted crop whatever time we wanted and everyone planted whatever crop; today we don't mix crops in a plot; we plan for the season and plant during the rains; we use improved seeds and fertilizers and the yields have increased. The

[89] Respondent ADT.

> many meeting local leaders and agronomist conduct especially when the season is approaching have influenced these changes [90]

While farmers articulated technical and institutional changes that had benefited individual farming, about 10% of respondents reported 'no change'. A farmer in Gatsibo district explained this:

> I see no difference in the way we farmed long ago and now, depending on the size of the land we still mix crops and we only use manure from livestock. We also still use traditional seeds, which we keep at home or buy, from the market. I therefore haven't experienced any changes in agriculture.[91]

Farmers who have not experienced significant changes in agriculture present a good picture of agricultural systems before government reforms. This farmer was not merely one voice in his neighbourhood. Other farmers interviewed in that locality have similar accounts. This suggests that there are isolated areas in which policy changes have not taken effect. While some have experienced 'no changes', other have even had negative experiences:

> Agriculture is difficult now compared to long ago, and output is declining because of soil infertility and lack of fertilizers. The other problem is the changing weather patterns as rain is unreliable now.[92]

Negative experiences were reported by 6% of respondents who believed that this was due to reduced soil fertility and changing weather patterns. While experiences have been mixed at the individual farm level, most farmers (84%) reported positive changes linked to the new reforms.

Policy makers were the next group to describe and explain the changes that had occurred in agriculture. Starting with an African Union (AU) representative, the observations of policy makers are highlighted:

---

[90] Interview with F26.
[91] Interview with F225.
[92] Interview with R32.

> Well, as a person at the helm of agriculture on the continent, I see Rwanda as one of the leading countries on the continent. (…) They have done better in increasing productivity on the farm. Of course there are some other countries like Ethiopia who also have put in so much. But Rwanda stands out in that they have organised the production, marketing and input delivery systems. These three are the main aspects, which impact positively on agriculture.[93]

As noted in Chapter 3 of this thesis, Rwanda has been ahead of many African countries in implementing the CAADP policies that aim to improve food security and poverty. The view of the AU representative is reflected in farmers' accounts, which were also echoed by policymakers. The policymakers' thinking about those successful changes are summarised in Table 5.3.

Table 5.3: Policy makers' perceptions of changes that occurred in agriculture since 2000

• Strong political will and commitment to transform agriculture • Policy and institutional reforms to improve the agricultural sector • Policy alignment from the national to grassroots level • Introduction of the Crop Intensification Program and increased use of improved seeds and fertilizers • Introduction of Land Use Consolidation that encourages collective action • Decentralisation and active participation of the of the districts in agriculture • Performance oriented policy implementation and monitoring • Increased productivity and agricultural output for farmers • Reduced proportion of the population in farming (from about 90% to 75%)

Source: survey data

[93] Interview with AUR.

Although these are high-level general comments, they can be linked to farmers' own assessments. For example, local leaders' increased interaction with farmers was due to the requirement for such interaction found in the decentralisation of policy. Likewise, the Crop Intensification Programme (CIP) promoted the use of improved seeds and fertilizers, which was mentioned by more than half the respondents as the most significant change in agriculture, and aimed to stimulate land productivity.

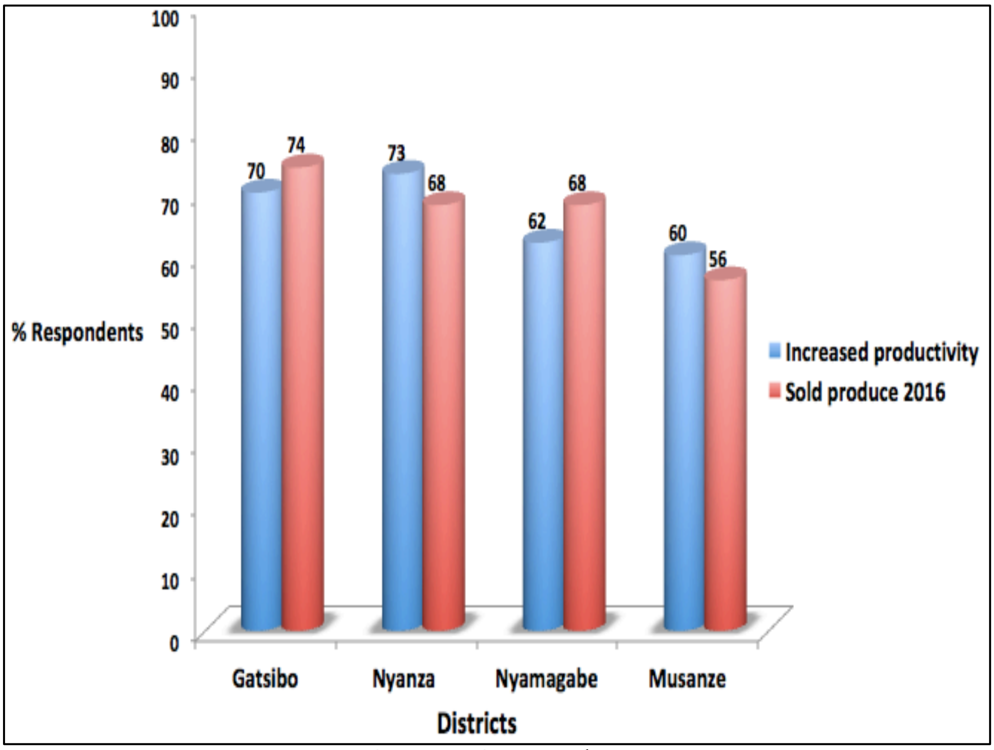
Most respondents reported increased productivity and commercialisation over the period of the study. Agricultural productivity was determined by asking farmers whether they produce more from their land now than they did before. Sixty-six percent stated that they harvest more crops from their land now, compared to 2000. Similarly, about 67% of the respondents commercialised agricultural produce in 2016, compared to only 55% in 2000. Furthermore, 61% of the respondents who commercialised agricultural produce in 2016 reported that the quantity sold was higher in 2016 compared to 2000. An assessment was conducted to show agricultural performance across the sampled districts.

Figure 5.2 compares the level of productivity and commercialisation between high performing districts (Category 1) and low performing districts (Category 2).[94]

Generally all districts exhibited higher agricultural performance. Although Nyanza and Gatsibo generally performed better than the rest, in all districts more than 50% of respondents increased agriculture productivity and engaged with the market as sellers of produce in 2016. This demonstrates a strong policy impact across a whole range of locations with different development statuses and agroecological features.

[94] Chapter 4 explains the categorisation of districts: Category 1 districts are those that have shown high agricultural performance (Musanze, Gatsibo) while those in Category 2 have low performance.

Figure 5.2: The proportion of farmers per district who increased yield and sold produce in 2016

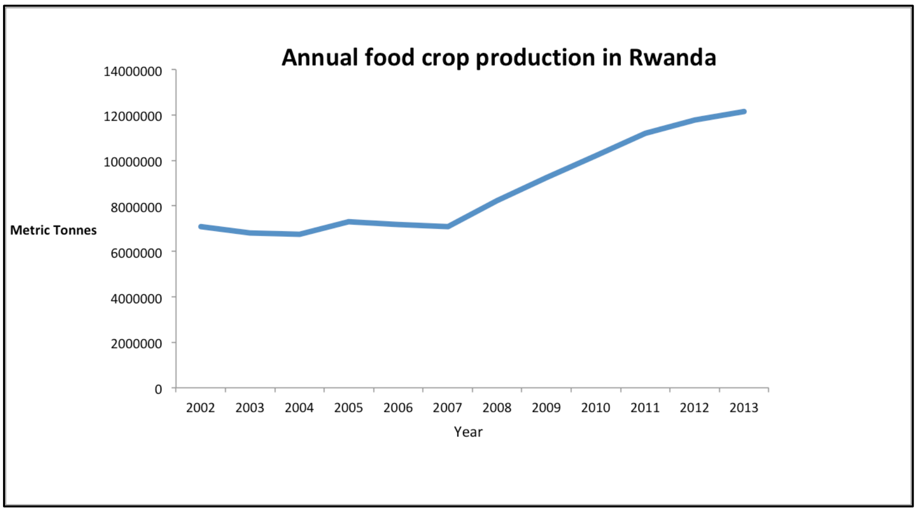


Source: Survey data

The results from individual farmers within the different districts were triangulated with national level production data. According to MINAGRI data, food production at the national level rose sharply after 2007 (Figure 5.3). While average annual food crop production between 2002 and 2007 was about 7 million metric tonnes, by 2013 it had increased by 70% to 12 million metric tonnes. Given that the rise in staple food production was after the launch of CIP in 2007,[95] the increase can be attributed to the new policy.

[95] Chapter 2, Section 2 explains the Crop Intensification Policy.

Figure 5.3: Annual food production (MT) in Rwanda from 2002 to 2013



Source: MINAGRI crop production database

Since the fundamental goal of agricultural transformation is to increase food production and improve people's lives, respondents were asked how they felt about their lives.

5.3 Is life today better, worse or the same?

During the survey, farmers were asked, '*Compared to 2000 is your life better, same or worse*?' Most farmers responded to this question and gave explanations for their answer (see Table 5.4). About 64% of the respondents said their lives were better compared to 2000, 10% said life was the same, and 26% said it was worse. The people whose life remained the same had the least to say (Table 5.4).

Table 5.4: Reasons why farmers' lives are better, same or worse

Better (N=183)	Same (N=29)	Worse (N=74)
I have sufficient food	My land is small	I am elderly and frail
I produce more crops on my land	I have no land and work for other people	I have health issues
I have more income	I have limited income	I have limited income and labour
I have a better house for my family		I have limited land
I can rent land and grow food		I have no land
I have medical insurance and better medical care		I have no employment
I have livestock		My land is infertile land and my harvest is low
I have work in agriculture and get other jobs		The weather is unreliable reducing my crop yield
I have hope for tomorrow		I am living with disability
I have more knowledge about improving productivity		Food prices are higher
I have good prices for my produce		I have limited food
There is security and I feel safe		

Source: Survey data

The top three most frequently mentioned reasons for life being better are: increased food, increased income, and better housing (Table 5.4). Other reasons include the ability to buy health insurance and access better healthcare services as well as owning livestock. Access to land, agricultural work and improved knowledge were important and presumably related to economic well-being. Having hope for the future and security were also mentioned several times, showing the impact of reduced day-to-day pressures and perhaps insecurities about the future. The responses show that farmers use different strategies in order to improve their standard of living:

> My life is good now, I have become cleverer, now I use improved inputs, which has increased my yield, and then I learnt how to save and not to waste money. I also learnt the benefit of selling crops in a group like a cooperative and avoid side selling.[96]

> My life is better because I have sufficient food, I can afford to buy clothes, when I get sick I have medical insurance. I even have a cow and drink milk.[97]

> Although not yet good enough, my life is better than it used to be. I now have a house and land. Although my land is small, productivity has increased - it is not low as before.[98]

Respondents mostly associated a better life with the ability to increase land productivity, food, and income. Although some still face challenges, the fact that they have experienced positive changes gives them a better outlook on life.

However, some say life has not changed. Those whose lives have 'not changed' associated their state with their limited or non-existent landholdings. Farmers in this category often turn to agricultural labour as a source of income for their daily needs including food:

> My life is the same because I still have no land.[99]

> According to me, there is not much change because of limited land.[100]

> I still live in the same house, working on other people's farms.[101]

Land size and quality are major determinants of whether people progress, get stuck or regress. Landless farmers have limited options and depend on selling labour, and they are the most vulnerable to shocks like drought. Interestingly, farmers' ability to cope with these issues seems to be associated with age. For

---

[96]Interview with FM3.
[97] Interview with FM105.
[98] Interview with FM2.
[99] Interview with FM202.
[100] Interview with FM41.
[101] Interview with FM183.

young respondents a declining quality of life was due to limited land and associated with declining soil fertility and the changing weather patterns. This condition is heightened by limited work and high food prices. A 25-year old respondent said:

> Having no land makes my life worse off.[102]

Others gave similar reasons:

> My life is becoming worse because of the many droughts, low crop yields, limited work to get income to help me develop.[103]

> My life is worse because before, I would have high yields, the soil was still fertile then and food prices were low[104].

> I moved from where I lived because my land had become unproductive, but even the small land I moved to, seems be similar to the previous one. [105]

Land size and its fertility are an issue, which is made worse as farmers move to more marginal land because of the demands of an increasing population.[106] In comparison, food production for respondents who are elderly is affected by declining health, a limited physical ability to engage in on- and off-farm work and limited access to labour:

> I am older and my land has become smaller, I have limited help, I have no one to help me plant on time, yet there is often dry spells and the weather is unreliable.[107]

> My life is getting worse because I am getting poorer everyday; there is not enough harvest to sustain my family yet I don't have the energy to work elsewhere for money.[108]

---

[102] Interview with FM40.
[103] Interview with FM86.
[104] Interview with FM55.
[105] Interview with FM231.
[106] Chapter 7 discusses the land problem.
[107] Interview with FM217.
[108] Interview with FM22.

> Life is worse because I am older; I am sickly and use most of my money for the hospital.[109]

The results in this section strongly suggest that policy intentions did result in the achievement of a form of 'development cooperation'; and that this promoted the realisation of desired outcomes. Although the chapter shows the widespread impact of the recent reforms on farmers, there are those who were unable to engage with the new policies: young people with limited or no land; the elderly who are too frail and unable to cope with the drudgery associated with intensive agriculture systems; and climate related challenges that undermine the use of high yielding technologies.

5.4 Summary

Over the period of the study, the majority of farmers increased crop yields, and they say life is better than it was in 2000. Most respondents attribute improved well-being to increased food and income. This chapter shows that the increase in food production in Rwanda, particularly after 2006, was a result of the government agricultural policies.

These findings are consistent with Poulton, et al. (2006); Timmer (2005); and Hazell et al. (2006), who all argue that to transform smallholder agriculture robust government policies and interventions are needed. It would appear that the 'development coordination' was realised between design and implementation of the agricultural policy. There does remain the issue that the coordination had a stronger vertical dimension and a weaker horizontal feature (Poulton, 2009), so that while the policy was adopted by a village all smallholders in the village did not benefit. These findings are more nuanced than the conclusions drawn by (Dawson, Martin, and Sikor 2016; Huggins 2017; Pritchard 2013; Ansoms 2009) that smallholder farmers would not cope with government policy and that these policies had increased food insecurity and poverty. On the contrary, this chapter shows that the new reforms have been successful to as a form of coordination through delivering a clear policy

[109]Interview with FM27.

and its constituent steps and that these reduced the transactions costs facing smallholders. It also was a significant first step in setting in motion a strategy of agricultural intensification that was to play a considerable role in generating meaningful changes for rural smallholders.

This chapter shows that changes at the farm level were stimulated by government reforms, founded on four things: 1) sustained agricultural prioritisation by the government; 2) a thorough analysis of the problem at the farm level; 3) a holistic approach to finding appropriate solutions; and 4) inclusive institutional implementation arrangements.

The premise on which the government adopted the stance of a 'developmental state', that undertook a state-led agricultural policy, made sense to the different stakeholders involved. Firstly, Rwanda was emerging from a genocide that destroyed the country's social and economic fabric and left many people in deep poverty. Secondly, the majority of the poor population was in rural areas with the land as the main resource. In principle, there was consensus on the nature of the problems in the agricultural sector, the need for change, and the importance of leadership. Farmers were very much aware of the huge transactional costs that faced them with regard to achieving agricultural security, and in this situation, they regarded the leadership as having the necessary tools to come up with policies that would benefit them.

In terms of the smallholders, the majority of farmers have benefited from policy, but there are also those who did not. For example, some took no interest in new agricultural technologies because of the land limitation. While transactional costs were reduced in relation to implementation of policy, it is clear that there remained insurmountable transaction costs that faced some smallholders. Furthermore, this section also highlights the demographic and environmental limitations that go beyond agricultural policies: these challenges require more comprehensive socioeconomic policies, such as those that are required to address some of the problems highlighted by youth and the elderly. The next chapter discusses the nuts and bolts of state led technology dissemination and adoption.

Chapter 6: Factors that affect technology adoption for smallholder farmers

> We have now seen that when we use improved seeds and fertilizers, our harvest is greater.[110]

The previous chapters of this thesis have shown that the rate of technological change at the farm level determines the pace and pattern of agricultural change. This means that the key decision-maker in the process of agricultural change is the farmer. Yet, in most cases, farmers lack the information, skills, technologies, finances and incentives to do so. In Chapter 5, respondents disclosed that the use of improved seeds and fertilizers was the most noteworthy change that occurred in agriculture. For most farmers, this would have been a new experience. This chapter investigates how issues of coordination, information asymmetry and limited finance in rural areas were addressed to facilitated access and adoption of new technologies among smallholders' farmers. The chapter draws from the farmers' survey, interviews from districts' agronomists, discussion groups, and a small sample of MINAGRI data to capture the process of technology change among smallholder farmers.

Section 6:1 investigates the significance of agriculture for farmers; Section 6.2 identifies what crops farmers grow, how they are growing them, and when they started growing them.

Section 6:3 provides information on farmers who apply chemical fertilizers and when they started application. This section also tracks technology adoption, highlighting the barriers and challenges rural farmers face in the process of technology. Using a logistic regression model,

---

[110] Interview with FM144.

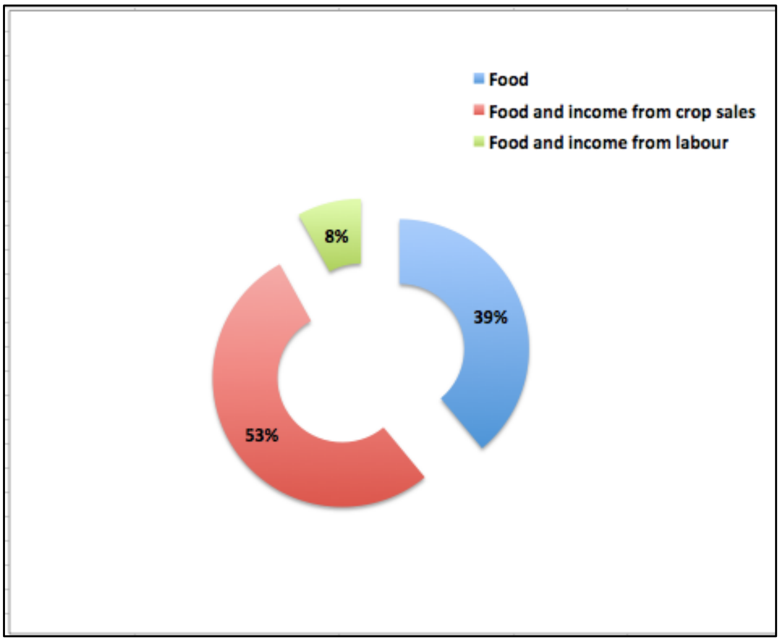
Section 6:4 identifies key factors influencing the use of improved seeds and chemical fertilizers

Section 6.5 shows the variations in agricultural performance among different sectors across Rwanda.

6.1 Reasons why agriculture is critical for rural farmers

Agriculture is the main source of food and income for all the surveyed respondents, with only 5% of the respondents reporting off-farm labour and small businesses as equally important. Figure 6.1 shows the reasons why farmers regard agriculture as critical:

Figure 6.1: Reasons why agriculture is important for farmers



Source: Survey data

All respondents rely on agriculture for food and 61% also depend on the sector for income. Of those who earn income from agriculture, 53% sell crops while 8% work on other people's farms. Respondents did report that they received some income from other sources.

Table 6.1 show sources of income for respondents in 2016. Respondents earned money from several avenues, including: crops; casual labour; livestock and livestock products; off farm activities; gifts; government social support (VUP);[111] monthly salary and land rents. The primary source of income for the majority (41%) of respondents was crop sales, followed by casual labour with 23%.[112] About 2% of the respondents said they earned no income in 2016.

Table 6.1: Sources of income for respondents in 2016

Source of income	**% Respondents**
Sale of own harvest	41
Casual labour	23
Livestock and livestock products	16
Of-f farm activities	7
Money gifts	5
VUP (social support)	2
Monthly salary	2
Land rents	2

Source: Survey data

The ability to earn income enables farmers to supplement the food they produce with purchases from the market. In 2016, the primary source of food for 85% of respondents was from their own harvests while 15% relied primarily on the market. Most farmers in the survey grow and sell traditional food crops.

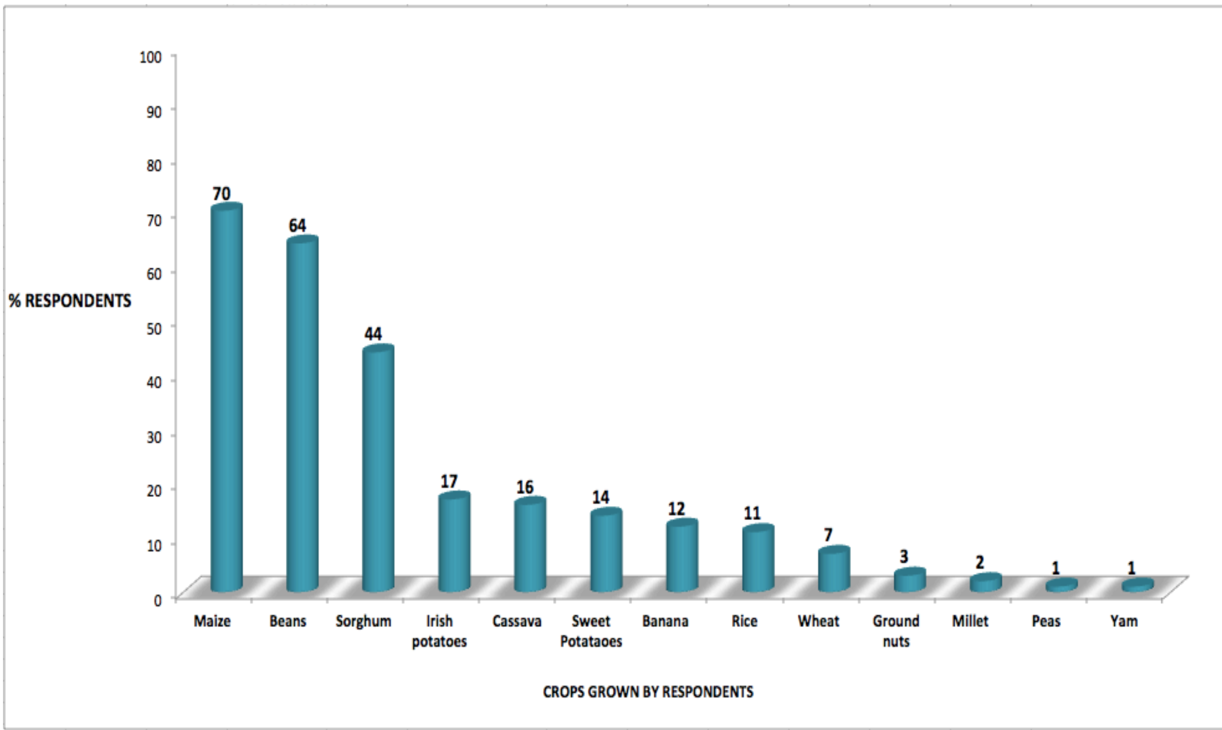
[111] VUP is a social protection program that supports poor and vulnerable people.
[112] Casual labour was not specific to agriculture activities.

6.5 The type of food farmers grow and methods used to produce it

Food crops grown by respondents include banana, sorghum, maize, beans, Irish potatoes, sweet potatoes, yam, cassava, soybean, wheat, rice, groundnuts and millet (Figure 6.2). Most farmers produce more than one type of crop a season. The most popular crops grown are maize, beans and sorghum. Crops grown by respondents in all the sampled districts include beans maize, sorghum, banana and sweet potatoes. Yam is also widely grown by respondents but only in small quantities. Some crops are only found in specific localities.

Cassava was found in all the districts except in Musanze; wheat and peas were found only in Nyanza and Nyamagabe; Irish potatoes only in Musanze and Nyamagabe, while groundnuts and millet were only found in Gatsibo district. The diversity of crops tells us that the type and range of crops grown by Rwandan farmers hasn't changed for decades.[113] There are changes in crop

Figure 6.2: The proportion of farmers growing particular food crops



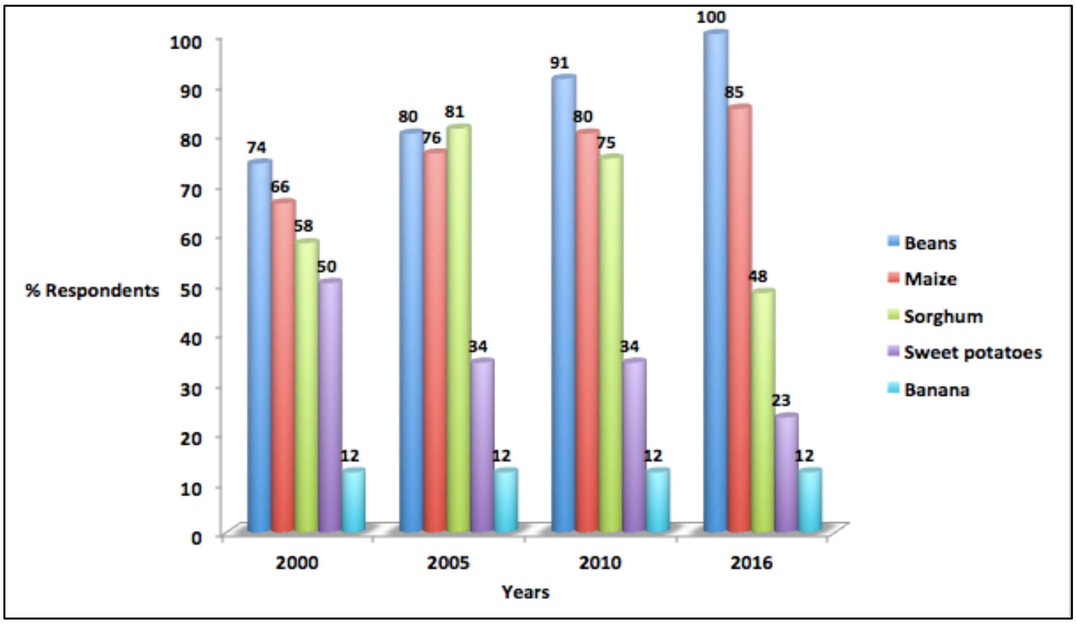
[113] See Chapter 2, Section 1.

production patterns observed after 2000 that could be attributed to a shift in government policy (Table 6.2).

Using the survey and the national crop production data from MINAGRI, this section examines production patterns of key food crops (that is, those crops found in all the sampled districts) to determine the possible effect of policy, particularly the CIP, on farmers' crop choices and output.

Figure 6.3 shows the proportion of respondents growing beans, maize, sorghum, banana and sweet potatoes between 2000-2016, while Figure 6.4 presents the national volumes of these crops over the 10-year period from 2002 to 2012. Although each set of data has a different perspective on crop production, they tell a similar story.

Figure 6.3: Crops grown by farmers in the period between 2000 and 2016



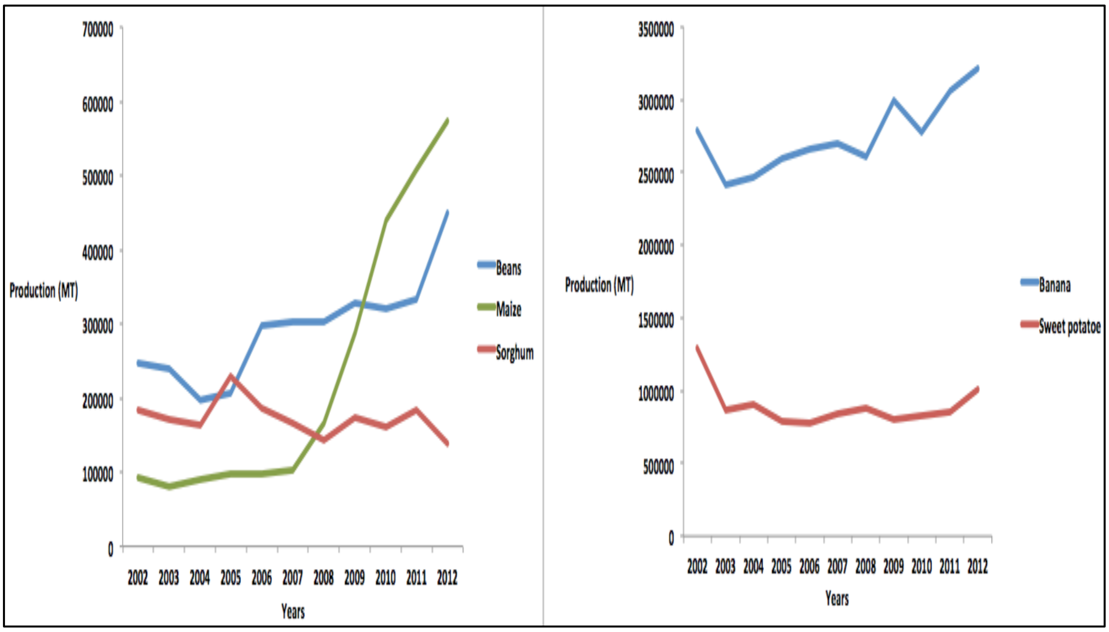
Source: Survey data

Figure 6.3 shows that beans, maize and sorghum remain important crops, grown by the majority of respondents. However, there are notable differences in the production patterns of these crops over the study period. Whilst the proportion of respondents growing beans and maize steadily increased, the numbers who grew sorghum decreased (Figure 6.3). In fact, all respondents grew beans at one point in 2016; those growing maize increased from 66% in 2000 to 85% in 2016, whereas the percentage of those growing sorghum was reduced by 10% from 58% in 2000 to 48% in 2016. These crop changes are mirrored in the national figures that also show that while beans and maize production increased radically, production of sorghum declined gently between 2002 and 2012.

As with sorghum, there was a reduction in the production of sweet potatoes both in terms of the proportion of respondents growing the crop, and the national output. A different result was seen in respect of banana production though; while the percentage of respondents growing banana remained the same, national production increased. This may indicate that once a farmer establishes perennial crops like banana they tend to keep them, and the crops keep producing. However, the significant increase in national production despite limited changes in the proportion of farmers growing bananas, may mean that these farmers increased yield or expanded the area under the crop.

National production of beans and maize also improved drastically, although the increase in the proportion of farmers growing these crops was gradual. For example, there was a 4% increase in respondents growing maize between 2005 and 2010 compared to the five-fold increase in national production in the same period. The fact that this change was triggered in 2007, when CIP was introduced, implies that these increases were due to increased productivity, and were driven by the use of new inputs.

Figure 6.4: National production of beans, maize sorghum, banana and sweet potatoes between 2002 and 2013



Source: MINAGRI database

Given that CIP promotes the use of improved seeds and fertilizers, it is not surprising that prioritised crops like beans, maize and banana have performed better than the non-prioritised sorghum and sweet potatoes (Figure 6.4).[114] Consequently, more farmers have turned to prioritised crops while turning away from those less prioritised. Moreover, because farmers have limited land, crop prioritisation is bound to lead to crop substitution. For example, the focus on rice irrigation in marshland valleys means that rice is replacing the sweet potatoes traditionally produced in these areas. Likewise, maize competes with sorghum, as they are both grown on hillsides and often in the same season (Table 6.2). Since CIP promotes monocropping per plot, it is likely that farmers replace sorghum with maize. However, to ensure food security, and because farmers have more than one plot, most grow various crops each season. For instance, only a few farmers produced one type of crop in each season of 2016 (Table 6.2).

[114] Crops prioritized by CIP include maize, beans, Irish potatoes, rice, cassava, wheat and banana.

Table 6.2: The proportion of farmers who produced a single crop of beans maize and sorghum in Season A and B 2016

Crops	Season A 2016 (%)	Season A 2017 (%)
Beans	17	3
Maize	5	17
Sorghum	6	13
Total	28	33

Source: Survey data

Note: Season B 2016 is 2016 January to June while Season A 2017 is August to December 2016

Only 33% and 28% of respondents produced a single season B 2016 and A 2017, respectively (Table 6.2). Others combined the production of beans, maize and sorghum with other crops or produced a different set of crops altogether. For instance, in season A 2016, about 20% of respondents produced maize and beans, each grown on separate plots. This is an indication that although policy promotes crop specialisation, farmers keep some level of crop diversity. Since farmers own at least two plots of land they are able to grow a handful of crops each year by rotating crops. It is important to note that crop decisions happen under serious land constraints. The majority of respondents grow crops on less than a half-hectare of land that is highly segmented.[115]

To address the land size issue, farmers were encouraged to work together by consolidating land use.[116] The land use consolidation policy within CIP encourages land neighbours to grow the same crops and work together to increase economies of scale, reduce transaction cost of in input and output markets. As confirmed by a district agronomist, land use consolidation was an innovative institution that facilitated farmers working together to overcome the constraint of land size and fragmentation:

[115] Chapter 7, Section 2 discusses ways in which farmers are dealing with the land constraint.

[116] Land use consolidation is explained in Chapter 2, Section 3.

> Most farmers have less than a half a hectare of land. Moreover, this land is in small parcels scattered in different locations. So a farmer will have 10 Ares [an are is 10X10m] in 5 different locations. (…). In the past, farming was very individualistic. Farmers made decisions about when and what to plant individually. But the land use consolidation policy has encouraged people to work together.[117]

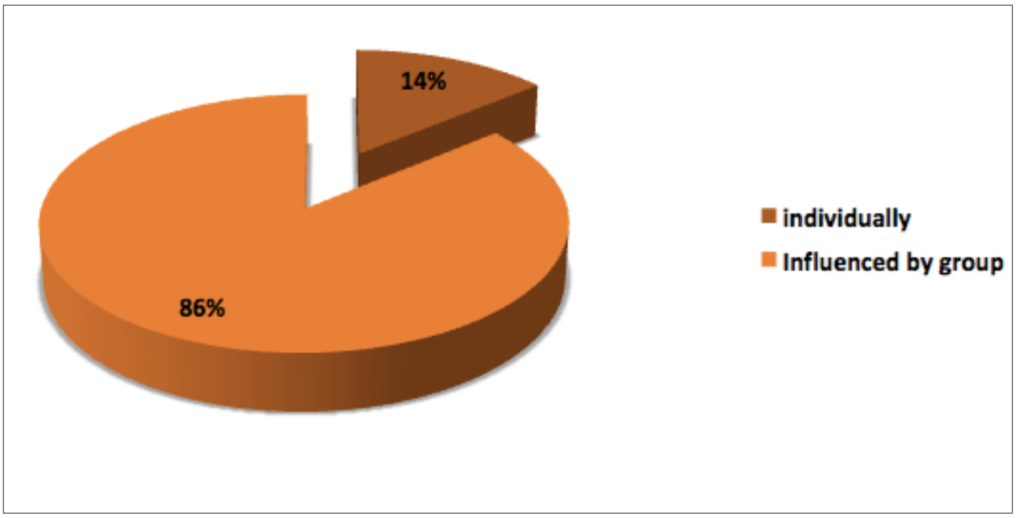
Farmers that agree to consolidate land often make cultivation choices together. They decide on what to grow and request seeds and fertilizers as a group. While land use consolidation facilitates access to inputs farmer show that, it has changed institutions that determine land use at farm level:

> Before, we never consolidated our land use, now we do. Farmers in a specific area decide which crop to grow and they plan to use improved seeds and fertilizers. For example in our area, Kabeza, we decided to grow maize this season. When we started to work together, we were able to get improved seeds and fertilizers. The benefit of land use consolidation is that you plan and work together and encourage each other to use new techniques. Before, everyone did his or her own planning depending on individual capacity.[118]

To determine the impact of the land use consolidation policy on crop selection, farmers were asked how they decide what to grow each season. Figure 6.5 summarises farmers' responses.

[117] Interview with MA.
[118] Group GNNY1.

Figure 6.5: Proportions of farmers and how they decide the crops they grow



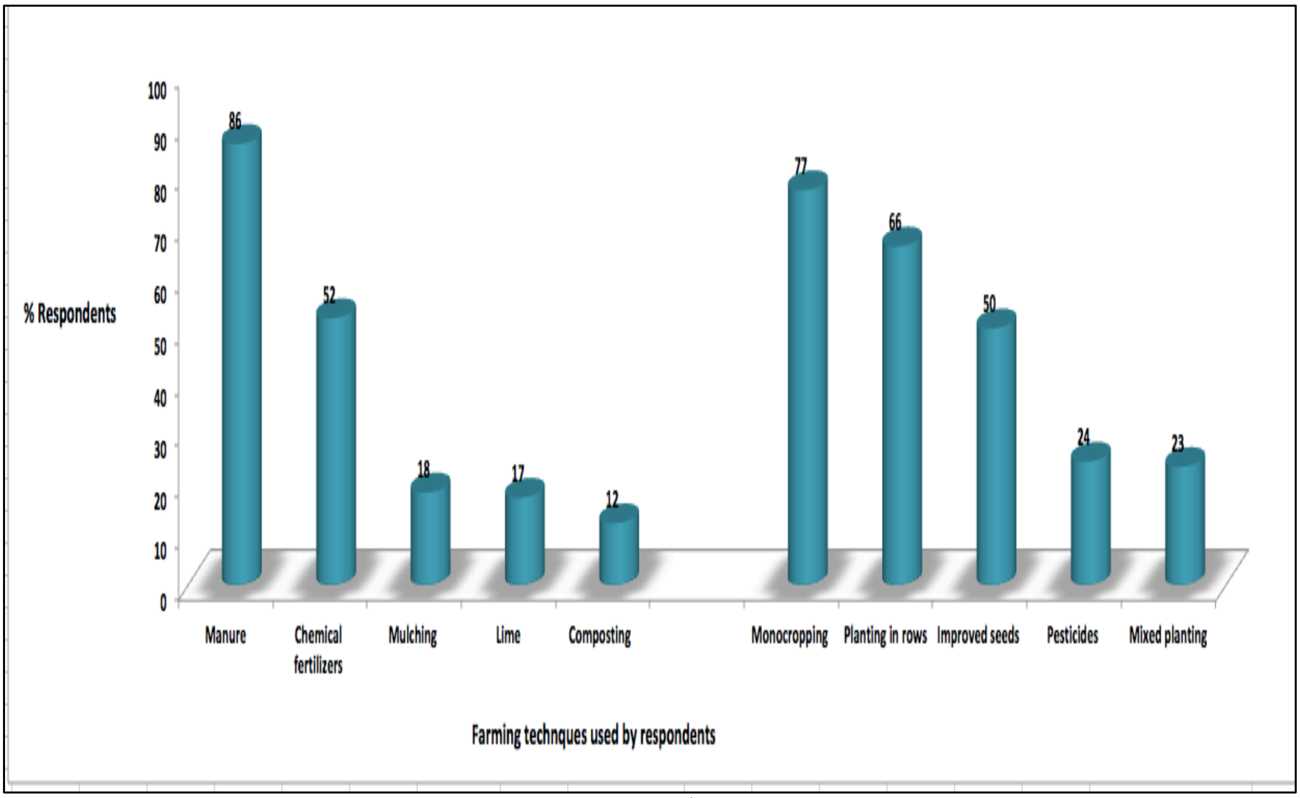
Source: Survey data

Figure 6.5 shows that 86% of the respondents decide what to grow after group meeting with fellow farmers, agronomist or local leaders. Most meetings happen before planting as farmers prepare for a new season. In fact, seasonal preparation meetings and launches are now institutionalised, and carried out at the national, provincial, district and sector level each season. These meeting are sometimes conducted by high level government officials, aiming to uphold agriculture as a critical pillar of national development and demonstrate that change starts with farmers making good choices at planting. Seasonal preparations meeting aims to provide information about inputs, encourage timely planting, and land use consolidation. As will be highlighted in Table 6.2 some farmers found local leaders' push for technology adoption stressful.

Farmers use different planting techniques to grow food (Figure 6.6). To increase soil fertility they apply manure, fertilizers, lime, mulching and compost. About 86% of the respondents apply organic manure, 52% use inorganic fertilizers and just under 17% use lime and 12% use compost.

Farmers who use inorganic fertilizer tend to integrate it with cow manure to get better yields.

Figure 6.6: The percentage of farmers and farming techniques used



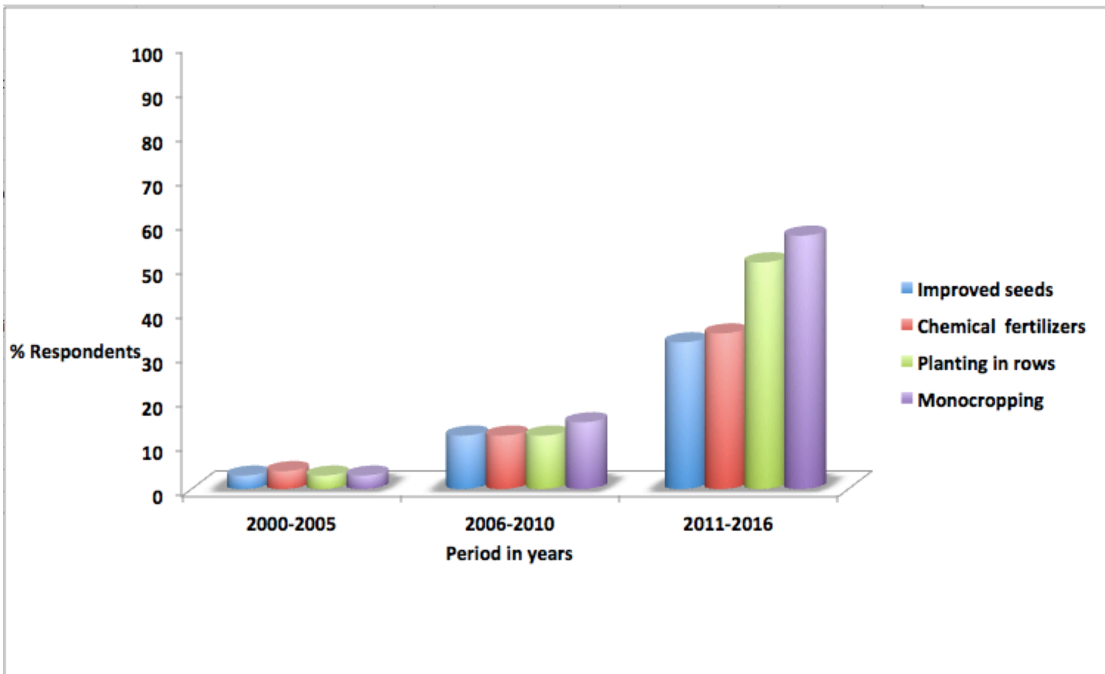
Source: survey data

Some (18%) use mulch to improve soil moisture and quality (Figure 6.6). In order to boost crop health and yield, respondents tend to use different techniques. Half of the respondents use improved seeds and fewer (less than 30%) use pesticides. Contrary to traditional methods of mixed cropping and broadcasting, about 77% of the respondents have switched to monocropping and 66% to planting seeds in rows.

Respondents started to switch to new forms of farming during the period between 2006 and 2010 (Figure 6.7). Before 2006, less than 5% of respondents used improved seeds and chemical fertilizers, and practiced monocropping and planting seeds in rows.

Figure 6.7 shows that the agricultural changes that began between 2006 and 2010 intensified after that period. While the number of farmers who started using improved seeds and fertilizers tripled between the two periods 2006-2010, and 2011-2016, those using monocropping and planting in rows quadrupled. This may suggest that the adoption of new agricultural technologies took different forms. While some applied the full CIP package of using manure, fertilizers, improved seeds, monocropping and planting in rows, others only adopted the easier and cheaper components like the use of manure (figure 6.6), monocropping and planting in rows.

Figure 6.7: Percentage of farmers and the period in which they started using new farming techniques



Source: Survey data

The fact that most respondents only adopted the associated new inputs and techniques some 3 years after CIP started to promote changes in agricultural practices in 2007, illustrates that time is an important factor for agricultural change. However, this section shows significant changes in agricultural technology use and farming techniques over the period of the study. It highlights land use consolidation as an innovative institution used to reduce the transaction costs of providing services and inputs to farmers.

This section shows that farmers still grow the same range of crops as before the reforms. However, the proportion of farmers growing CIP prioritised crops increased gradually after 2007, which has led to an interesting shift in the land use patterns. Since farmers' land is highly fragmented, they can grow CIP prioritised crops on some plots and maintain a variety of other crops on other plots. For example, only about 30% of farmers produced a single crop in 2016, while the rest harvested a variety of crops on different plots. In this case, land fragmentation allows for crop diversification, while allowing for land use consolidation. The next section examines the route taken by farmers to adopt new technologies and the reasons why some failed.

6.3 Farmers' interaction with new farming techniques

This section captures the adoption process of new agricultural technologies by smallholder farmers. It only considers the new technologies promoted by CIP: improved seeds (high yielding seed varieties) and fertilizers (chemical fertilizers). These technologies are also associated with monocropping and line planting. The section analyses the course of adoption, starting from when a farmer first hears about these inputs to when they adopt them. The section also identifies the challenges which farmers face in the process, and key barriers to agricultural technologies adoption.

Information about the new seed and fertilizers originated from different sources including friends and family, television, sector agronomists, lead farmers, local leadership meetings, and project agronomists (Table 6.3).

Table 6.3: Source of information about the new inputs

Source of information	Improved Inputs: N=144 Respondents (%)
Agronomist	35
Rural projects	28
Lead farmers	10
Local leaders	10
Television	10
Friends and family	7

Source: Survey data

Note: Role project include agronomist and training programs

Agronomists and government projects played an important role in technology diffusion. In addition to disseminating information, agronomists and projects conducted training and facilitated access to new inputs for farmers. Other sources of information about the new inputs were lead farmers,[119] local leaders, television, and friends and family. Farmers say that living in communities (umudugudu)[120] makes communication between friends and family better:

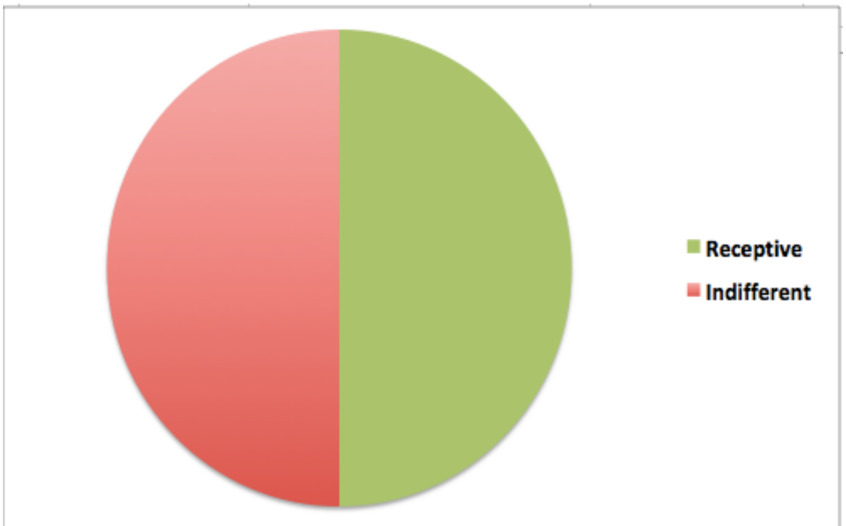
> What I can say is that living in a 'umudugudu' has really helped because we live near each other. In a mudugudu you chat with your village mates in the evening and get news. We learn from each other.[121]

119 Lead farmers lead by example by practicing new techniques on their plots and encouraging the neighbours to do the same.

120 A 'umudugudu' is the formal community designed, after administrative reforms in 2005, to enhance community mobilisation and empowerment. Once a site is located, communities moved to a 'umudugudu' where they live near each other.

121 Group GNY1.

Figure 6.8: Percentage of farmers and the first reaction to new inputs



Source: Survey data

Once the farmers had heard about the new inputs the next step was to decide whether to try them. One of the survey questions asked farmers what the initial reaction to the new technologies was. Apart from 12% who did not respond to this question because they had not been in contact with the new inputs, the rest of the respondents had varying responses. Figure 6.8 show that the farmers' reaction was polarised, with half of the respondents resistant to the new technologies and whilst the rest were more receptive. The farmers' first response was based on rational considerations and influenced by the methods in which they received the information about the technologies. As a district agronomist said, 'farmers were confident in the traditional ways of farming, that is why to convince them there are better ways of farming was difficult.'[122]

[122] Interview with ADM.

Table 6.4: Reasons why respondents were receptive or indifferent about new technologies

Responsive N=127	**Farmers (%)**	**Indifferent N=126**	**Farmers (%)**
Wanted to increase yield and tried	64	Not convinced the new technologies increase yield	28
Heard about the inputs after a training event and was convinced	7	Afraid of the change	11
Saw the impact of the new technologies in the field	4	Thought the technologies were difficult to apply and time consuming	11
Simply tried because others were using them and they worked	6	Afraid that monocropping would lead to hunger	28
Trusted the leadership to have found appropriate technologies	4	Did not like that the leadership was telling us what to do with our land.	2
New planting techniques required less seeds at planting	2	Thought Government would take our land	3
Wanted to try although had limited resources (land, money and information)	13	Thought chemical fertilizers can damage soil	5
		Saw no need for new technologies	12

Source: Survey data

The majority (64%) of respondents who were receptive about the new technologies were convinced that they could increase land productivity and were willing to experiment (Table 6.4). Those who had learnt about the new technologies by seeing the on-field impact or through training were also convinced of their potential. A few (4%) said that since the inputs were promoted by local leaders and government officials, they believed they were authentic and worth trying. The different reasons behind farmers' reaction towards new technologies are summarised in Table 6.4.

The fact that the new ways of farming were associated with techniques like placing seed in rows instead of broadcasting appealed to some respondents (2%), because they saved seed (Table 6.4). For some, it was peer pressure that led to positive reactions; they did not want to be the odd ones out. As expressed by a farmer in Gatsibo, generally, receptive respondents were willing to take the risk of trying new technologies:

> We said to ourselves, let us try using the new inputs and see.[123]

While some were keen to try, others were sceptical. Farmers' initial apprehensions about the new seeds and fertilizers were linked to the implications of technological change on household food, time and resources. Table 6.4 shows that the 28% of the respondents doubted the potential of the new inputs to increase yield, while others (13%) were content with traditional methods, and didn't want change. A few respondents (2%) wondered why government officials and local leaders were meddling, given their limited involvement in individual farm activities in the past. A farmer remarked that some farmers misread the sudden interest of the government and suspected they could lose their land to the state:

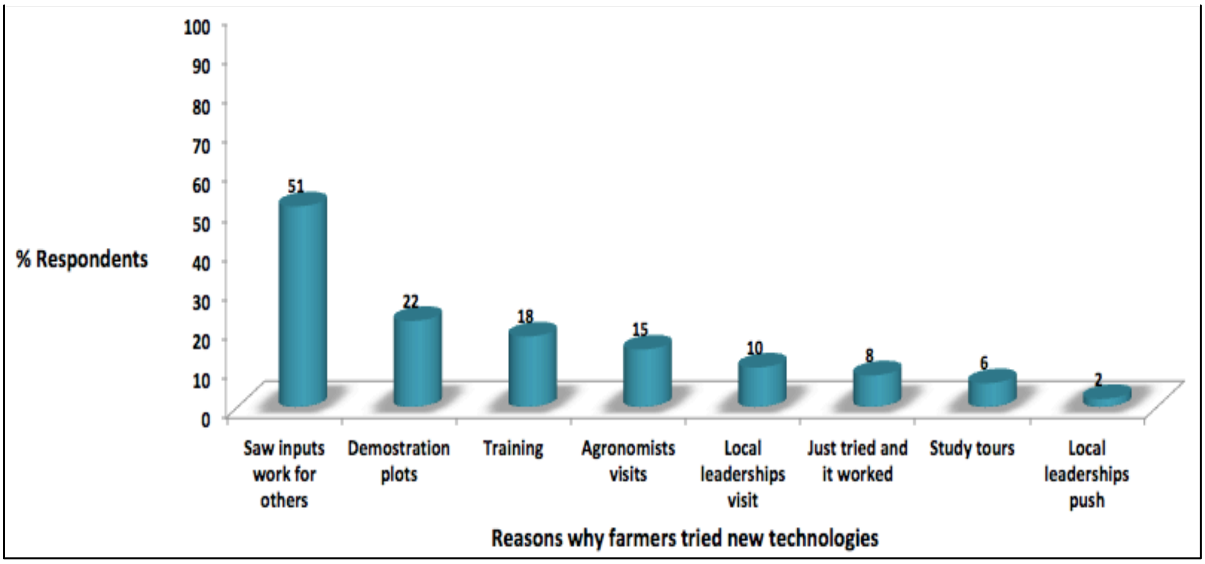
> We were not happy about new technologies as we thought we would eventually lose our land.[124]

Some farmers were afraid of adopting the technologies because of associated risks. For example, some respondents (28%) were afraid that monocropping and crop specialisation would lead to hunger; others (5%) worried that fertilizers might eventually destroy the soil. Despite these varied concerns, most respondents who were initially apprehensive adopted the new inputs in the long run. Fifty-eight percent of respondents who were initially unreceptive had adopted the new seed varieties by 2016. Figure 6.9 presents the various approaches used to persuade farmers to adopt the new ways of farming promoted by CIP.

---

[123] Interview with FM283.
[124] Interview with FM274.

Figure 6.9: Methods used to convince farmers to adopt new technologies



Source: Survey data

Some of the key methods used to persuade farmers to try out the new technologies included training, demonstration plots, study tours, agronomic visits, local leadership visits, and seeing their impact on farms (Figure 6.9). Farmers said that seeing the performance of the new technologies on farm had the greatest impact on adoption:

> We usually select representatives, who receive training. Once they are trained, they also train other farmers. But those who are trained also put what they learnt in practice so that others can see. When farmers see that what was taught is profitable and good, they then start to take it up. We all have our ways of doing things but after training, one realises that the new knowledge is helping improve traditional farming practices.[125]

According to a district agronomist, seeing the impact of the new seeds and fertilizers in other people's fields had the biggest impact on adoption.

[125] Interview with NK2.

> When farmers noticed that those who had applied fertilizers were getting better yields they began to request for it.[126]

As a farmer from Musanze also explained, seeing other people's experiences increased the confidence to adopt the new inputs:

> I found the idea of growing one crop at a time difficult, as I thought that would lead to hunger. But in one season I saw that my friends who had grown a single crop and used fertilizers had significantly increased yield and earned money, I wanted to try the new inputs as well.[127]

Farmers were also able to see the impact of the technologies through demonstration plots. During a group discussion, farmers highlighted why demonstration plots, allowing people to see the impact first, were effective ways of promoting the new inputs:

> Demonstration plots were so critical; we were able to see what happens when one uses new techniques, like fertilizers, improved seeds and frequent weeding. We were able to appreciate that these practices led to increased yield. We noticed that although we all put in the same amount of work, farmers who applied new inputs and practices got more yield than those who didn't. For example, in rice production, the difference between those who used inputs and those who didn't was 2 tonnes of rice per hectare. Farmers whose harvest was low were then encouraged to adopt the new inputs the next season.[128]

Interestingly, while interactions with local leaders encouraged some, others felt compelled by them to accept the technologies. As farmers elaborated, the involvement of the local leadership in technology dissemination had mixed outcomes:

---

126 Interview with MHFP.
127 Interview with FM20.
128 Group GGG5.

> Our local leaders come to talk to us. They often tell us that using improved seeds and fertilizers increases agriculture output. Our leaders often inform us when they find solutions that could improve our lives.[129]

> I found it difficult to let people tell me what to do on my land. So I took my time. The leaders started telling us about the new inputs in 2012 but I only started using them in 2015.[130]

> They told us that growing one crop in a plot was good; I thought it was difficult but because the leadership promoted the practice, I did it.[131]

The local leadership worked together with agronomists to promote the new technologies among farmers. One agronomist disclosed that the problem was that the new technologies were costly:

> Initially, it was difficult because we were introducing new technologies to farmers. The first 2 years were particularly difficult. Firstly, people didn't have money to buy fertilizers and high yielding seeds, and these inputs were expensive.[132]

Despite the complexity of the process, by 2016 more than half of the respondents had adopted improved seeds and fertilizers.

A number of things had to be aligned to facilitate the adoption of technologies.[133]

---

[129] Group NNy1.
[130] Interview FM30.
[131] Interview FM53.
[132] Interview MNFP.
[133] Chapter 2, Section 3, describes the introduction of seed and fertilizers by the government.

Table 6.5 underlines what farmers regard as fundamental in this process of technology adoption. Respondents were asked, 'what did you find most helpful in the process of adopting new technologies?'

Table 6.5: What farmers found most helpful during the process of technology adoption

What did you find most helpful?	**% Farmers**
Access to subsidised seeds and	29
fertilizers	29
Access to information, advice, meetings	
and field visits from extension agents	23
Extension advice and subsidised inputs	10
Demonstration plots and training	9
Local leadership meetings	

Source: Survey data

Most respondents say the ability to access information, subsidised inputs and technical advice were most critical for technology adoption. According to farmers agronomist and local leaders were the change agents for technology adoption. Although the new and productive inputs could be accessed in rural areas, farmers needed to understand the process of accessing them and how to use them. In some cases, some farmers needed input credit. Table 6.6 presents the challenge of technology adoption faced by farmers.

Table 6.6: Farmers' concerns about technology adoption

Issues raised by farmers	**% Farmer**
Erratic rainfall	64
Inputs are expensive	22
Delays in input delivery	16
Small land	12
Inputs are not available	8
Limited knowledge on input use	2

Source: Survey data

Weather was the biggest concern for respondents. The challenge of unreliable rainfall was mentioned by 64% of the respondents (Table 6.6). For these farmers, unreliable rains and drought has led to setbacks in the adoption of technologies. The resulting low yield makes it difficult to raise sufficient income from crop sales to pay for existing input debt, or make investment for the next season.

Sporadic weather is not a new phenomenon for Rwandan farmers, considering that in the past famines were common.[134]However, because farming was mostly individualistic, and seed planting was done at different times, the effect of diverse weather varied among farmers. Such traditional subsistence methods are similar to those described by a farmer in a Gatsibo village in which agricultural practice has not changed:

> We still mix many crops in one plot. Everyone still cultivates whenever they feel like, and plant seed whenever they have time. Sometimes one is planting while another is weeding.[135]

In agriculture systems where farmers make a larger investment in agriculture and engage in more coordinated planting activities, the weather effects tend to cause more losses, be more noticeable, and, as farmers stated, a bigger cause for worry:

> Long ago, we never worried about crop yields or rain. When it was planting time, we put seed in the ground knowing the rains would come. Today, if we do not plant and apply fertilizers on time, we know that harvests will be low. The rain patterns have changed.[136]

---

[134] See Chapter 2, Section1 which discusses famines in Rwanda before 2000.
[135] Interview Fm256.
[136] Group NNy1.

Other challenges mentioned by respondents include input cost, availability, delays in delivery, limited knowledge of input and small land. This comment from a Gatsibo farmer indicates that those with very small land are also likely to be poor and unable to afford the new inputs:

> I liked the technologies but I cannot adopt them because of the small land and limited finances.[137]

In addition to cost, some farmers say the new agricultural systems are labour intensive:

> Today's agriculture is tiring because when I arrived here in 2000 no one applied fertilizers on their land. Now we have to use fertilizers because the land has become infertile. To be able to get money for fertilizers I have to look after someone's cattle.[138]

Affordability, labour requirement, reliability are factors considered by farmers before technology adoption. Unreliable supply of inputs leads to delays in planting, which may cause farmers to return to traditional techniques. In fact, most (58%) ranked cow manure as the most preferred technology because it is easily accessible, cheap and has the ability to increase yield. Given these attributes, the percentage of respondents using manure increased from 40% in 2000 to 85% in 2016. Some of the farmers using manure (45%) have not adopted the new technologies while the rest integrate the use of inorganic and organic fertilizers. The noticeable increase of soil fertility measures may be an effect of policy that has lead to more access to advisory services for farmers. Lack of information is a barrier to technology adoption.

When asked why they do not use any new technologies, respondents highlighted the six main barriers listed below:

---

[137] Interview with FM278.
[138] Interview with FM251.

1. Improved seed is not available nearby;
2. Improved seed and chemical fertilizers are expensive;
3. Deliveries of the new inputs are often late;
4. We have no information about the new technologies;
5. Land is small;
6. These new inputs are not necessary, we save seed from harvest and use cow manure.

Half of the respondents who did not adopt any new technologies say they were constrained by limited information and finances, late input deliveries, lack of technology access, and limited land. Same respondents found the technologies unnecessary.
The process of technologies adoption was stressful for farmers. This section shows strong involvement of local leaders and extension services in transmitting information and encouraging farmers to adopt new technologies. Despite the 'aggressive cohesive measures' for enforcing policy alleged by (Dawson, Martin, and Sikor 2016; Pritchard 2013; Huggins 2009;) only 2% of respondent farmers say they adopted the use of the new inputs because a local leader pushed them into it. Farmers' reactions towards the active engagement of local leaders in agriculture was mixed. For some farmers, the engagement of local leaders gave them the confidence to adopt new technologies, while others disliked local leaders telling them how to use their land.

When it came to the actual adoption of the new technologies, the most convincing factor, according to most farmers' responses, was seeing the potential of the new inputs to increase yield. This is contrary to what one would expect in a situation where government policy implementation is through coercion. This section has shown that the adoption of improved seeds and fertilizers was gradual, with farmers taking up these technologies over time, and this fits well with institutional explanations that show that it is often more difficult to achieve horizontal coordination in poor communities when there has been a recent history of conflict and distrust in the community

(Ostrom 1990). The next section statistically analyses factors that influenced farmers' adoption of new inputs.

6.4 Statistical analysis of factors influencing adoption of agricultural technologies

As discussed in the earlier sections of this chapter, and highlighted in the literature, the decision by farmers to adopt new technologies can be influenced by social, cultural, economic, institutional and environmental factors.[139] Since the extent to which these factors affect adoption choices is contextual, this section identifies factors important for technology adoption for farmers in Rwanda. Using a logistic regression model, the section analysis the factors that affect the adoption of improved seeds and chemical fertilizers by farmers.

A logistic regression model is used to assess the likelihood to adopt, or not to adopt, a new technology.[140] The dependant variable is dichotomous, adoption or non-adoption of improved seeds and chemical fertilizers. While this model considers an adopter as one who uses improved seeds and fertilizers, it does not investigate how much of these inputs are used.[141] The model is used to determine social, economic and institutional independent variables that influence farmers' adoption choices. It determines the degree and direction of the relationship between the dependent and independent variable at an individual farm level. The dependant variable is technology adoption, 1 - representing farmers who have adopted improved seeds and fertilizers and 0 - for non-adopters. The variables included in the model are those highlighted in the literature as factors likely to affect farmers' adoption of new technologies.

---

[139] See Chapter 3, Section 2.

[140] The general logistic model is discussed in Chapter 4, Section 7.

[141] About 95% of respondents who use inputs have adopted both improved seeds, and chemical fertilizers.

There are 15 independent variables included in the model (Table 6.7). The variables are: age, gender, average household size, formal education, land size, number of plots, number of assets, maize grower, access to extension services, membership of a cooperative, access to credit, commercialisation, income from sales 2016, district sector category and average time to the sector. Each of the independent variables is explained, to justify their inclusion in the model and the type of relationship with the dependent variable expected.[142]

Studies have shown that the **age of a farmer** is likely to have an effect on technology adoption (Alexander and Mellor 2005). As modern inputs are capital and labour intensive, adoption can be challenging for both younger and elderly farmers. While younger farmers tend to be limited by resources, the elderly are constrained by declining health and physical abilities. As such, technology adoption may increase with age as the stock of resources and experience in farming increases, but decline as a farmer gets older.

Gender is an important aspect of technology adoption. Since the adoption of improved seeds and chemical fertilizers depends on access to resources like land and finance, it is likely that people who have these resources benefit more from the new technologies (Doss 2001). A MINAGRI study in 2010 showed that men had better access to resources including finances, time and information, making them better positioned than women to adopt new technologies(MINAGRI 2010). Furthermore, new forms of farming like planting in rows may demand more work and time, overloading women, who in addition to agricultural work, have also got the responsibility of routine domestic duties. Over the last 15 years, government policy in Rwanda has aimed to give equal opportunities to both men and women. However, given inherent gender inequalities, the prospect of men adopting a new technology is higher.

[142] Table 4.7 in Chapter 4 summarizes the independent variables used in the model.

Household size is a measure of labour availability (Mwangi and Kariuki 2015). The bigger the size, the more likely a household is able meet the labour requirement and the risks associated with the adoption of new technology. The average household size for respondents was 5 people. A Rwandan household is defined as a nuclear family consisting of mother, father and children. However, as the result of the 1994 genocide, many households have adopted orphans. In this study the household is the nuclear family living under the same roof.

Formal education provides individuals with the ability to process information quicker, which may aid the decision to reject or adopt a new technology (Wang et al. 2017). About 61% of the respondents have formal education, but mostly only up to primary school level and of these 91% can read and write. The ability to read and write is social capital that could lead to opportunities. For instance, farmers who can read and write may be prioritised for community leadership roles, making access to information and resources easier.

Land size and the number of land plots in Rwanda are a very limited resource and farmers operate on small plots that are very fragmented.[143] In such a scenario farmers are likely to adopt land- saving technologies like high yielding seeds and chemical fertilizers to increase agricultural productivity (Uaiene 2009). However, as mentioned in the earlier sections of this chapter, land scarcity, is a barrier to technology adoption for some farmers.[144] Farmers with larger farms may have more room to try out new technologies compared to those with smaller land. For instance, a farmer with more land may find it easier to assign some of it to the Land Use Consolidation Program and access new technologies through CIP, while a farmer with only single plot may be more hesitant to do this.

---

[143] Land scarcity and productivity is discussed in Chapter 7.
[144] Table 6.6.

Maize is one of the main crops grown by farmers and prioritised by the government through CIP.[145] Maize therefore makes up a high proportion of the improved seed distributed among farmers each year.[146] As the inputs are issued to farmers as a package, it is anticipated that those who adopt improved maize seeds also apply chemical fertilizers.

Extension services are part of the CIP package provided to farmers. Extension agents organise discussions, meetings, training sessions and individual visits for farmers in order to provide the information and knowledge needed to adopt new technologies. The ability to access advice and information increases the likelihood of adopting a new technology. Therefore, farmers who have advisory services are more likely to adopt new technologies compared to those with limited access.

Line planting and monocropping were techniques promoted together with the new inputs. In order to get the full benefit of using these inputs, the agronomic advice given to the farmers was to plant the seeds in rows with specific spacing and grow a single crop per plot to increase yield. It is expected that farmers who practice line planting and monocropping techniques are those who use improved seeds and fertilizers.

Members of a Cooperative are more likely to have greater access to improved technologies compared to those who are not (Abebaw and Haile 2013). Agricultural cooperatives facilitate access to information and link members to markets. Cooperative membership is therefore likely to have a positive impact on technology adoption.

Similar to cooperatives, **farmers Associations** are likely to have positive influence on technology adoption**.** Farmers Associations are small and informal groups of farmers who come together to learn from each other, access

[145] Figure 6.2.
[146] See Chapter 2, Section 2.

inputs with the aim of increasing crop yield.[147] Since these groups lead to economies of scale and increase visibility, they are a likely target for input suppliers. Being a member of a farmers' association is, therefore, likely to increase the adoption of new technologies.

Farmers' ability to **access credit** reduces the cash constraint to purchase inputs(Mohamed and Temu 2008). SACCOs are organisations promoted by the government to facilitate rural access to finance.[148] Considering that finance is a key constraint for rural farmers, access to credit can stimulate technology adoption.

Commercialisation has been shown to have a positive impact on the adoption of new agricultural technologies (Awotide, Karimov, and Diagne 2016). On the other hand, households that adopt new technologies tend to shift to market oriented agriculture (Kaliba, Verkuijl, and Mwangi 2000). In this study, a farmer is considered commercial if they sell crop output. Nahayo et al. (2017) found that farmers who access the market were more likely to participate in crop intensification.

The **household assets** recorded in this study include, land, house, telephone, mattress, TV, radio, bicycle and livestock. Livestock is an important component of the rural agriculture economy. The types of livestock included in the study are goats, sheep and cows. In Rwanda, cattle are traditionally valued and a symbol of wealth. Wealth is an important feature of technology adoption (Just and Zilberman 1983). It is assumed that compared to poor farmers, wealthier farmers find it easier to bear the risks associated with adopting new technologies. Farmers with more assets are therefore likely to have the financial capacity to purchase the fertilizers.

[147] Farmers organisations are discussed in detail in chapter 8 section 1

[148] Section 8.1 discusses the impact of farmers organisations.

A sector is a territorial administrative entity, authorized to implement development programs at the cell and villages level. Each sector has agronomists that coordinate agricultural activities. Several meetings and agricultural related training sessions are organised within a sector. In addition, at the start of the season, sector offices are sometimes used as distribution points for seeds and fertilizers. Therefore, proximity to the sector office could increase access to information and new inputs, which could motivate adoption.

Respondents were selected from two **categories of district sectors**: high agricultural performing sectors (Category 1 dummy variable of 1), and low agricultural performing sectors (Category 2 dummy variable of 0).[149] Although this categorisation is based on people's (MINAGRI staff and District agronomist) perceptions, sector agricultural performance may be related to technology uptake. It is likely that sectors that perform well in agriculture have higher levels of technology adoption and productivity.

The relationship between each independent variable and the dependent (adoption of seeds and fertilizers) variable was analysed, and the results are presented in Table 6:7.

Results show that 7 variables were significantly correlated with the adoption of improved seeds and chemical fertilizers. The variables significantly associated to technology adoption were: the number of assets, maize growing, access to extension services, cooperative membership, the district sector category and average time to the sector.

---

[149] See discussion of methodology in Chapter 4.

Table 6.7: The statistical result of the logistic regression analysing the effect of technology adoption on farmers

Independent Variables	B Coefficient	S.E.	Wald	DF	Sig.	Exp(B)
Age	-0.014	0.013	1.125	1	0.289	0.986
Gender	0.639	0.412	2.403	1	0.121	1.894
Household size	-0.036	0.078	0.214	1	0.644	0.965
Education	0.558	0.417	1.794	1	0.180	1.748
Average Hectares	0.015	0.223	0.004	1	0.947	1.015
Maize Growing	1.411	0.378	13.908	1	0.000***	4.101
Access to extension services	1.584	0.397	15.919	1	0.000***	4.873
Membership to Cooperative	1.457	0.608	5.741	1	0.017*	4.291
Membership to Sacco	0.528	0.398	1.762	1	0.184	1.695
Membership to farmers' Ass	0.122	0.569	0.046	1	0.830	1.130
Sector Category	1.114	0.391	8.124	1	0.004**	3.046
Time to the sector	-0.007	0.004	3.767	1	0.052*	0.993
Monocropping and line cropping	2.052	0.403	25.910	1	0.000***	7.784
Commercialisation	0.634	0.407	2.430	1	0.119	1.885
Number of assets	0.090	0.053	2.878	1	0.090*	1.094
Constant	-5.052	1.313	14.798	1	0.000	0.006

***,**,* significance at 1%, 5%,10% probability respectively

No significant relationship was found between technology adoption and, age, gender, formal education, average land size, membership to a cooperative, membership to a farmers' association, access to credit, and commercialisation. These relationships are further explored in the following paragraphs.

Age had no statistically significant relationship to technology adoption, but it had a negative B coefficient. The result suggests that younger farmers were more likely to use new technologies. The anecdotes in Chapter 5 indicate that the new inputs were labour and capital intensive, making adoption harder for elderly farmers.

The result shows that although **gender** was not significantly correlated to technology adoption, it had a positive B coefficient. Contrary to the findings of a study conducted by MINAGRI in 2010, the results suggest that women are more likely to adopt new technologies than men. The result of this study could mean that the effort of the government to ensure access to economic resources for women are beginning to pay off. One of the most significant government incentives is the equal right to land ownership between men and women.

Household size has a positive relationship with technology adoption. Although the variable is not statistically significant, it can be inferred that larger households are more inclined to adopt new agricultural technologies. Since subsistence farmers rely heavily on family labour, large household provide the manpower required to engage labour-intensive technologies. Also, larger households, have more mouths to feed, and this may be an incentive to adopt more productive technologies to increase food production.

Farmers Association has no significant relationship with technology adoption. However, the positive relationship indicate that members of small farmers' associations are more likely to adopt new technologies. Chapter 8 will shed more light on the structure of small farmers' associations and the ways in which social capital provided in these groups advances technology adoption.

Formal education was not correlated with technology adoption. Although most farmers had only attained primary education, the positive relationship between formal education and technology adoption indicates that farmers with formal education are more likely to adopt new technologies.

Results show that **land size** was not statistically significant to technology adoption, but it had a positive coefficient. As already noted, most respondents have smallholdings. However, these results imply that farmers with larger pieces of land are more likely to adopt new inputs. As shown in Chapter 5, farmers who operate on very small land do not find the use of capital-intensive technologies feasible. Conversely, farmers with bigger land may have the flexibility and resources to try out new seeds and fertilizers.

As expected, **Access to extension services** was highly correlated to technology adoption. Having access to an extension agent increases the probability of adopting new technologies. On their visits, extension agents relay information about new solutions and talk to farmers about general agricultural improvement. During these visits, farmers are also able to discuss their experiences and challenges, letting the extension agent get a good understanding of issues on the ground. As expressed by a respondent in Nyanza district, 'frequent agronomist visits build relationships and trust, giving us farmers confidence to respond positively to their advice and trying out the new technologies.[150]

Access to credit and being a member of a SACCO are both not strongly related to technology adoption.[151] This result is contrary to the study of Mohamed and Temu (2008) that show strong statistical linkages between access to credit and the adoption of agricultural technologies. However, the positive and significant correlation between the number of assets and technology adoption indicate that farmers with more resources and assets are likely to adopt the new technologies. Farmers with more assets tend to be wealthier and able to afford the capital needed to engage in productive agricultural systems.

Cooperative membership had a statistically strong relationship with technology adoption. Being a member of a cooperative increases the likelihood of adopting new technologies. This is expected as cooperatives facilitate access to information, training, and technical services for farmers. In most cases,

---

[150] See Chapter 6, Section 3.
[151] Chapter 8 sections 1 provide details on the role of SACCOs in technology adoption

cooperatives are also the distributor of the new inputs. An in-depth discussion of cooperatives and their role in agricultural transformation is found in Chapter 8.

Farmers that grow maize were found more likely to adopt new technologies. Considering that maize is one of the key crops prioritised by CIP, farmers growing maize are more likely to access to improved seeds and fertilizers compared to those who grow other food crops. Looking at 2016, 82% of respondents who applied the Daimmonium Phosphate (DAP) fertilizer were maize growers.
Farmers that apply improved seeds and fertilizers were encouraged to adopt the line cropping methods and monocropping. This explains why line cropping and monocropping were also strongly correlated to the use of improved seeds and fertilizers. These approaches were promoted together with extension services as a crop intensification package to farmers.

Commercialisation had a positive impact on technology adoption. However, contrary to the findings of Nahayo et al. (2017), the relationship was not statistically significant. Subsequent chapters show that the size of landholding is a major constraint to commercialisation.

Distance to sector office had a negative coefficient, and it was statistically correlated to technology adoption. This suggests that farmers who live near the sector office are more likely to adopt new technologies compared to those who reside further. This makes sense considering that sectors are in many cases, distribution centres for information and inputs. Farmers living close to sectors office can, therefore easily access information and inputs. Additionally, farmers who live near the sector office may become an easy target for sector-based agronomists and receive frequent visits and advice.

Whether a farmer belongs to a Category 1 or 2 sectors influences the likelihood of technology adoption. Results show that farmers in category 1 sectors were more likely to adopt new technologies. The good agricultural performance noticed agronomists in Category 1 sectors could be attributed to the fact that more farmers in those sectors use improved seeds and fertilizers compared to those in Category 2 sectors. The next section reassesses variables found to be significant to technology adoption in this section, at the district sector level, to understand the variation between sector categories better.

6.5 Understanding disparities in technology adoption among sectors

Using cross tabulation statistical analysis, a list of variables relevant to technology adoption were compared between Category 1 and 2 sectors (Table 6.8). These include the use of improved seeds and chemical fertilizer, access to extension services, membership of a cooperatives, number of assets, maize cultivation, land size, productivity, commercialisation, and income earned from crop sales in 2016.

Table 6.8: Comparing different variables between Category 1 and Category 2 sectors

Variable (N=288)	Cat 1 High performing sector N=144)	Cat 2 Low performing sector Cat (N=144)	Chi-Square value	Sig
Use improved seeds and fertilizers (% Respondents)	63	44	9.434	0.002**
Member of cooperatives (% Respondents)	24	17	2.159	0.093*
Grow maize (% Respondents)	63	60	.235	0.358
Access extension services (% Respondents)	64	58	2.461	0.074*
Average number of assets	5	6	-	-
Land size (ha)	0.53	0.46	-	-
Income from crops 2016 (Rwf) (% Respondents)	150,000	100,000	-	-
Increased yield (% Respondents)	99	94	.393	0.308
Sold produce to the market in 2016 (% Respondents)	74	57	9.00	0.002**

Cross tabulation was only done for categorical data

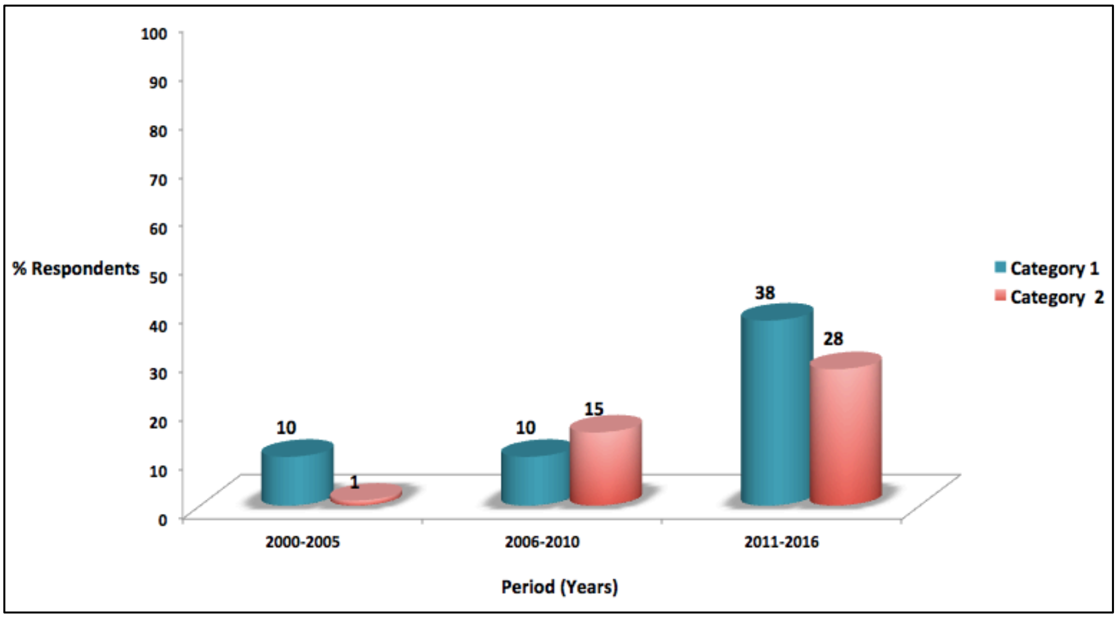
There was no significant difference in the percentage of farmers who grow maize and increased productivity between Category 1 and 2 sectors (Table 6.8). Although the average size of land in Category 1 was slightly larger than Category 2, there was no significant difference in the number of assets owned by respondents between the two categories. However, the proportion of farmers using improved seeds and chemical fertilizers, accessing extension services and selling produce was significantly higher in Category 1 sectors compared to Category 2.

In 2016, the average income from crop sales for farmers in Category 1 sectors was approximately 150,000Rwf (£150), which is 50,000Rwf (£50) more than those in Category 2. This more subjective measure supports the anecdotal evidence that the extent which farmers have increased productivity is higher for Category 1 sectors compared to Category 2. The greatest differences between Category 1 and 2 sectors are the level of adoption of improved inputs and commercialisation. More extension services and membership of a cooperative have a significant impact in terms of adoption of new technologies and access to markets.

Agricultural technology adoption and commercialisation are closely linked. The use of improved seeds and fertilizers leads to better yields and greater commercialisation whilst in contrast, the higher income from crop sales provides farmers with the finances needed to purchase improved seeds and fertilizers. With a higher proportion of farmers using improved seeds and fertilizers, increasing yield and earning higher income from agriculture, Category 1 sectors seem to be responding better to policy than Category 2. Further analysis is undertaken to understand why farmers in Category 1 sectors have an edge over those in Category 2.

Firstly, this is not a story of extremes; in terms of technology adoption both Category 1 and Category 2 have done considerably well. Looking only at the adoption of improved seeds, Figure 6.10 reveals that the technology adoption disparity seen between Category 1 and 2 sectors existed before policy reforms. Prior to 2006 and CIP, about 10% of respondents (double the national average) in Category 1 already used improved seeds compared to only 1% in Category 2 (Figure 6.10). This seems to have given farmers in Category 1 sectors an advantage over those in Category 2 sectors, starting from a low baseline. Despite very low numbers at the beginning, there was consistent increase in the adoption of improved seeds after 2006. This shows the effectiveness of a policy applied under extreme conditions, including communities performing considerably well and those doing poorly.

Figure 6.10: Period in which farmers in Category 1 and 2 started using improved seeds



Source: Survey data

What this tells us is that communities move together. It was evident during the survey that there were clusters of varying performances within communities. For instance, in Cyuve sector (a Category 1 sector in Musanze district), there was a community where all the farmers had adopted improved seeds and fertilizers and had access to extension services and another where none had adopted these inputs or accessed extension services. While the first 10 households sampled in Cyuve sector (Numbers 1 to 10) had adopted improved seeds and chemical fertilizers and 5 out of the 10 farmers access extension services, another 10 (Numbers 19-29) from the same sector, did not use these inputs and had only 3 out of the 10 farmers access extension services. In both communities, farmers engaged with each other and interacted with local leaders on agricultural matters.

The difference between the two communities is that one is part of CIP and the other is not. The first group (Numbers 1-10) had consolidated land towards the production of maize, Irish potatoes and beans (CIP prioritised crops) while the other (Numbers 19 to 29) cultivated sorghum, yam and beans (non CIP prioritised crop). Farmers that consolidate land towards the cultivation of CIP prioritised crops seem to attract more extension services and agro dealers who supply seeds and fertilizers, promoted as a CIP package. Consequently, policy seems to have created groups of farmers that are progressing together and attracting other services important for improving productivity. However, these services seem to be limited among communities who do not grow CIP prioritised crops like farmers 19-26. Improving community-to-community interaction through study tours could improve peer-to-peer learning, increasing the likelihood of sharing information about new technologies within sectors and between districts.

6.6 Summary

Agricultural intensification requires a range of support services that enable access to information, knowledge, and technologies for rural farmers. This chapter shows that since 2000, the majority of farmers have adopted new patterns of farming, such as improved seeds, chemical fertilizers, manure, line planting, and monocropping. At the introduction, half of the farmers were receptive to the new inputs, while the other half was indifferent. Initially, farmers were concerned about undertaking these practices as they had limited information about the likelihood of success of these unfamiliar production methods and very little understanding of the market for the products that they were cultivating. It is in this classic weak market, and high transactions cost constellation that there is an urgent need for a state-led agricultural policy (Kirsten, et. al, 2009).

The shift in technology use involved active interaction between MINAGRI, local leaders, extension services, agro-dealers and farmers. Improved seeds and fertilizers were subsidised by the government to reduce input costs and increase affordability among farmers. Additionally, the land use consolidation model enabled collaboration among farmers and reduced transaction costs of providing rural services. Devolving functions like the provision extension services, mobilisation of farmers and monitoring of input distribution previously provided by the central government (MINAGRI) to districts meant that these services were provided by institutions close to farmers, reducing policy implementation costs.

In particular, the chapter highlights the role of decentralisation in the process of agricultural change. Farmers' reaction towards the active engagement of local leaders in agriculture was mixed. For some farmers, the engagement of local leaders gave them the confidence to adopt new technologies, while others disliked local leaders telling them how to use their land. About 2% of respondent farmers say they adopted the use of the new inputs because a local leader pushed them into it. As described in this chapter, initiating meaningful agricultural change was stressful for both the government and farmers.

As Juma (2016) highlights, anxiety and uncertainty are a normal part of the agricultural technology adoption, particularly in the initial stages of the process. Despite these tensions, my research shows that at the onset, with the rolling out of the agricultural policy, and particularly with the dissemination of extension service and guidance that reduced the informational asymmetry that faced these smallholders, some farmers were willing to try the technologies in the hope that they had potential to increase crops. By ignoring the story of the receptive farmers, Huggins (2009) and Pritchard (2013) offer a one-sided view of the farmers' response to the new technologies. It is still the case that not all farmers did take up the new methods in the first instance and this is in keeping with different households given their individual demographic size and skills varied their ability to overcome transactions costs at the outset.

When it came to the actual adoption of the new technologies, the most convincing factor, according to most farmers, was seeing the potential of the new inputs to increase yield. This is contrary to what one would expect in a situation where government policy implementation is through coercion as alleged by Dawson, Martin, and Sikor (2016); Pritchard (2013); and Huggins (2009.) This chapter has shown that the adoption of improved seeds and fertilizers was gradual, with farmers taking up these technologies over time, and this fits well with institutional explanations that show that it is often more difficult to achieve horizontal coordination in poor communities when there has been a recent history of conflict and distrust in the community (Ostrom 1990).

Despite significant changes over the period of the study, farmers still grow the same range of crops as before the reforms. However, the proportion of farmers growing government prioritised crops increased gradually after the launch of CIP in 2007, which has led to an interesting shift in land use patterns. Since farmers' land is highly fragmented, they tend to grow prioritised crops on some plots and maintain a variety of other crops on other plots. For example, only about 30% of farmers produced a single crop in 2016, while the rest harvested a variety of crops on different plots. In this case, land fragmentation supports crop diversification, while allowing for land use consolidation.

In terms of technology adoption, all sectors performed reasonably well. However, farmers in sectors known to display strong performance in agriculture (Category 1) were found to have high levels of technology adoption compared to those that perform relatively poorly (Category 2). One key reason for this disparity is that Category 1 sectors that were already performing better than category 2 sectors before the agricultural reforms thrived after the new policies. This indicates that the new reforms have not eradicated, so far, the disparities that existed in agricultural performance before the reforms.

A logistic regression analysis shows that factors that significantly affect technology adoption include access to extension services, type of crop grown, use of line cropping and monocropping, membership of a cooperative, proximity to the sector offices, and the type of sector a farmer belongs to. These factors are all linked to government policy, and the crop intensification approaches adopted. The number of assets, which is a proxy for being wealthy, had a significant influence on technology adoption. The key barrier to technology adoption for most farmers was poverty. Farmers say that the critical challenges to technology adoption, are drought and land scarcity. The next chapter surveys approaches used to achieve increased productivity under these conditions.

Chapter 7: Working in confined spaces: Farmers' ways of dealing with Land and Water scarcity

Land scarcity and drought pose the most significant challenges to food production in Rwanda. Population pressure limits the extent to which farmers can expand their scale of operations. In addition to this, about 95% of farmers grow food under rain-fed agriculture, which is vulnerable to fluctuating weather conditions such as unpredictable rainfall patterns and increased temperature. Climate change has caused these events to occur more widely and are becoming more typical.[152] Chapter 2 of this thesis discusses policy instruments aimed to tackle issues of land productivity; land tenure security; land husbandry, and irrigation water use and management. This chapter assesses farmers' responses to these policies and examines mechanisms used by farmers to deal with challenges related to land and water use. It also analyses factors that have contributed to yield increases among farmers. Data sources for this chapter include the survey, group discussions, and secondary data from government documents and other sources.

The chapter is divided into 3 sections: drawing from the farmers' survey, section 7.1 discusses the land challenge and how it is being addressed, and assesses the process by which farmers access land. Section 7.2 uses group discussions to describe the irrigation water management model used by farmers; and section 7.3 uses survey data to analyses factors that have been important in enabling increased land productivity for farmers using survey data.

7.1 The land challenge: land scarcity and soil erosion

[152] Trenberth (2011) Changes in precipitation with climate change <http://www.int-res.com/abstracts/cr/v47/n1-2/p123-138/>.

During the survey, farmers were asked what the biggest issue concerning land was. While 19% of the respondents say they have no land related issues, the significant majority stated various challenges (Table 7.1). As anticipated, the key issues mentioned by most respondents were limited land size, soil erosion and infertility. A few respondents had legal issues concerning land ownership and some had experienced delay in receiving land titles. The biggest issue for 6% of the respondents is that they do not have any land. These land challenges limit farmers' ability to increase food production sustainably.

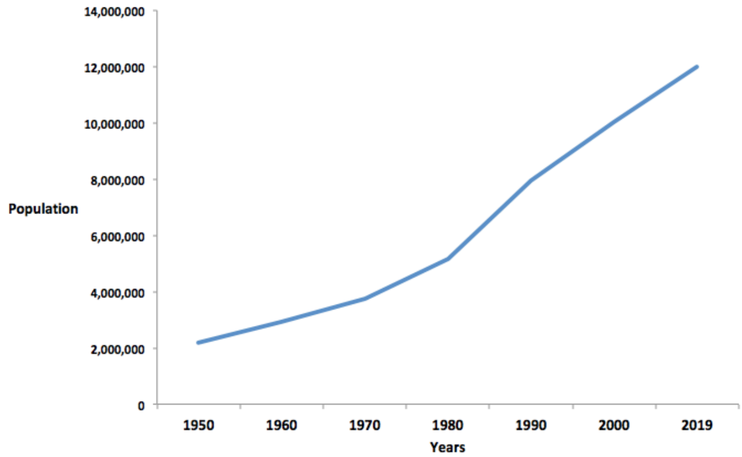
Table 7.1: Key problems relating to land

The challenge	% Respondents
I have a small plot of land	44
Land is infertile and prone to soil erosion	22
I have no problems	19
I have no land	6
There are delays in issuing the land title	5
I have legal issues concerning land ownership	4

Source: Survey data

Land scarcity and degradation is one of the greatest challenges of agricultural transformation in Rwanda. The country only has an area of 26,338km^2, of which 60% is on slopes (GoR 2004a) and 39% of the land is at high risk of soil erosion (MINAGRI 2004). Over decades, land has continuously been cultivated to produce food for the rapidly growing population. Since the 1980s, Rwanda's population has more than doubled (Figure 7.1), reaching a population density of close to 500 people per square kilometre, one of the highest in Africa. Population increases have had a massive impact on land as more land is occupied and divided.

Figure 7.1: The population in Rwanda from 1950 to 2019



Source: World population prospects 2019

Farmers say that household land size has shrunk, pushing cultivation to marginal and steeper land:

> You know, long ago we did not have to cultivate on very steep land like now, cultivation was mostly in valleys and on gentle slopping hills.[153]

Given the scarcity, access to land is an important aspect of agricultural transformation in Rwanda, and farmers have had to devise different mechanisms for dealing with the land challenge:

> When the population increased, we started to put more effort in agriculture, because land size started to reduce. We needed to do something to increase yield. (…) With reducing size, it was important that we protect the land we have.[154]

Land access in this thesis refers to an individual's rights to use land for agriculture. All the respondents interviewed during the survey have access to land for seasonal agricultural production. Respondents access land through

---

[153] Group NNY1.
[154] Group NK2.

inheritance, purchase, renting and borrowing (Table 7.2). Average land size per respondent is modest, of only about 0.49ha, and many operate on much less.

Table 7.2: Ways in which farmers access land for agriculture

Mode of land acquisition	% Respondent	Average land size (ha)
Inherited	74	0.33
Purchased	46	0.50
Rented	28	0.25
Borrowed	7	0.29
Redistribution program	3	0.1

Note: One farmer may acquire land from many sources
Source: Survey data

Farmers acquire ownership of land through inheritance, purchase and land redistribution. About 94% of the respondent's own land, while 6% are landless. Landless farmers access land for agriculture through renting or borrowing. However, the average size of rented or borrowed land is small (less than 0.3ha) which is a limiting factor for the landless. Very few respondents access land through land redistribution. As shown in Table 7.2, the source of land has an influence on its size. Purchased land is relatively bigger compared to land acquired through inheritance, renting, borrowing or distribution. Irrespective of the source, plot size per family is generally tiny.

Table 7.3 shows that close to 50 % of respondents have a land size of 0.20ha and less and about 19% have more than the national average of 0.6ha or more. Regardless of the size, land is highly segmented, mostly because the common way of acquiring land is through inheritance, where land is subdivided and passed down to individual members of the next generation. The number of plots owned by individual farmers is a good indicator of the extent to which land is fragmented. The average number of plots per respondent is 2, but fragmentation increases with land size (Table 7.3).

Table 7.3: Respondents' land size, number of plots and household size

Average landholding (ha) per HH	% Respondent	Average number of plots	Average HH size
0	6	0	4
>0.2	46	2	5
0.21-0.4	20	2	6
0.41-0.6	10	3	6
0.61-0.8	4	4	6
0.81-1	7	4	7
1.1-2	5	4	7
<2	3	4	7

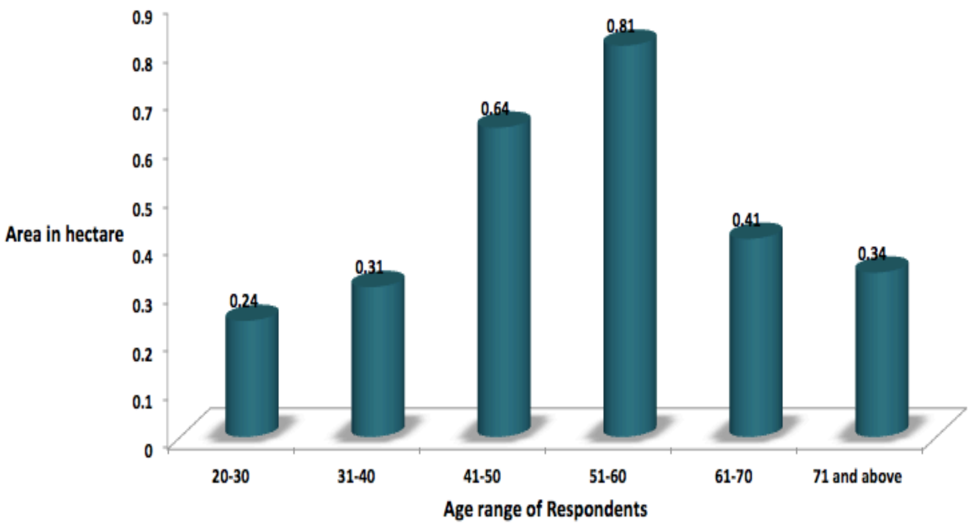
Note: HH-Household
Source: Survey data

While the average travel time to farmers' nearest plot is 5 minutes, meaning that they tend to have a plot of land near their homes, average travel time to the furthest land is 20 minutes. Long distance travel to and from different plots on difficult terrain may result in the loss of economic time by household members. However, in this case greater fragmentation does not necessarily result in long travel distances for farmers. However, generating sufficient food for the household can still be difficult with tiny and scattered landholdings.

The average household size per respondent is 5 people.[155] Table 7.3 shows that respondents with larger parcels of land also have larger households, while those with small plots or no land have relatively small families. This suggests that as individuals increase their resource base, they tend to have more children. Household size and access to resources is linked to age (Figure 7.2). The younger or more elderly respondents are, the more likely they are to have smaller households and land size.

[155] The fourth Integrated Household Living Survey 2013/2014 shows that the national household size is 4.6 people.

Figure 7.2: Changes of land size with respondents' age



Source: Survey data

Looking at Figure 7.2, it is clear that as respondents get past the 20-30 age group, average land size increases, and as they get older (above 60 years) it reduces. Like a life cycle, average land size rises after 30, is highest between 50 and 60, and begins to reduce after 60 years. Land is smallest for younger respondents, who are likely to inherit, borrow or rent small pieces of land; and the elderly, who pass on part of their land to their children. As a result, the youngest and oldest generations are most affected by land scarcity. Considering that land scarcity may be at varying degrees in different locations, this study looks at land-led migration.

To investigate land-led migration, one of the survey questions asked farmers why they chose the location in which they live. Table 7.4 summarises their responses. Only 11% of the respondents moved to their present location in search of agricultural land, which suggests limited land-led migration.

Table 7.4: Reasons why respondents live in their current location

Why do you live here?	% Farmers
I came to start a family	41
I was born here	30
I came to search for agriculture land	11
I resettled in a mudugudu	6
I was resettled here after genocide	5
I came to find a job	3
I was relocated here after losing my land to an infrastructure project	3
I wanted to live near the main road	1

Source: Survey data

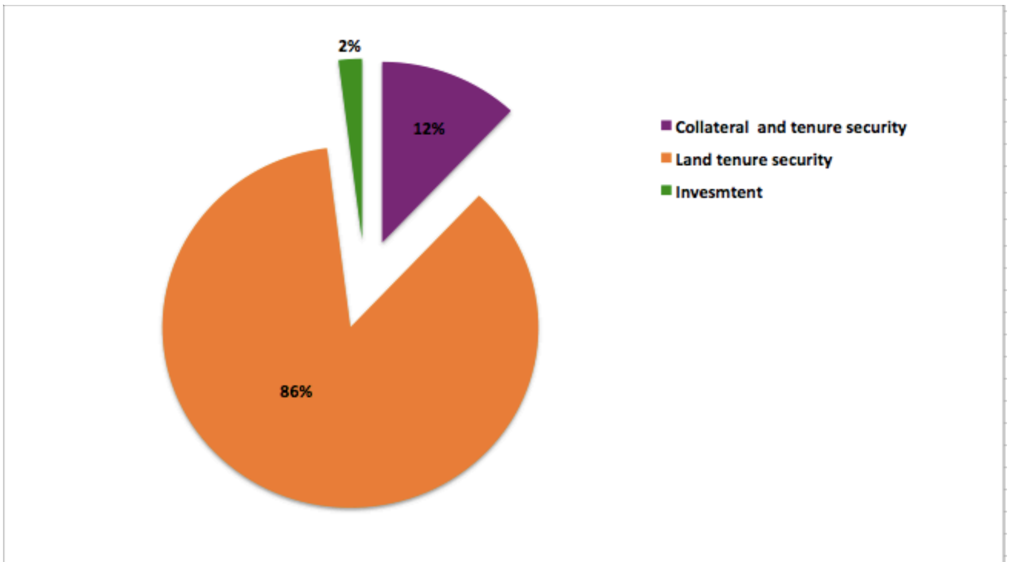
The average period for which respondents have lived in their current location is 28 years. Generally, farmers tend to stay in the location of their birth or marriage. Other reasons for moving to a new location are finding a new job, living near the main road, living in a Mudugudu (planned village), resettlement after an infrastructure project or as a refugee returning home after the genocide. As land is limited, once people move to a new location, they tend to settle and acquire land for agriculture. Pressure on land has led to continuous cultivation, degradation and competition for agricultural land. To safeguard land ownership and incentivise investment in land protection and productivity, the government introduced mandatory land titling.

In 2004, Rwanda began land reforms aimed at increasing land tenure security.[156] Faced with land scarcity, waves of returning refugees, land disputes, increasing landlessness, land degradation and low productivity, restructuring of the prevailing land laws was necessary in order to promote stability and economic development. For this reason, the government opted for registration and titling of all land. Land titling confers security of tenure by registration, giving rights of land ownership to the landholder. Land users

[156] See Chapter 2, Section 3 where the land reforms in Rwanda are discussed in detail.

are issued with a 99-year lease for each parcel of land they own.[157] To assess the effectiveness of this program, farmers were asked whether they hold a land title deed, and, if so, how it benefits them.

Figure 7.3: Farmers' benefit from land titling



Source: author's source

Close to 90% of the respondents who own land have title deeds. A female farmer from Musanze, one of the most densely populated districts, said, 'with a title for my land, I feel settled here.'[158] This was echoed by 86% of the respondents, who say that land registering and titling has increased tenure security (Figure 7.3).

Having a land title gives farmers a sense of security, which in Kinyarwanda they called 'umutekano' (feeling safe and secure), knowing they have the right to land without external interference. In particular, land titles help people to settle, and limits the land disputes that typically exist among family members. Along with feeling secure, 12% of respondents say land titles act as a

[157] Revised Land Law 2013, Article 5.
[158] Interview with FM27.

guarantee for credit[159] and 2% reported increased investment on the land after acquiring a land title.

Generally, with title deeds, farmers have the freedom to use and invest in land without the fear of losing ownership. Respondents who had title deeds said they also had the liberty to participate in the land market.

An assessment of respondents' level of participation in the land market indicates that farmers tend to buy rather than sell land. Since 2000, about 33% of respondents have bought land, compared to only 8% who sold land. It is not surprising that land sales are lower, considering its cultural value. Land in Rwanda is of great significance; it embodies lineage and cultural significance, and is the main source of food and income for rural dwellers. Given its significance and scarcity, land in Rwanda is of great value and in great demand. Yet because families own small plots, land sales present the risk of landlessness and poverty. In fact, of the respondents who sold land since 2000, one became landless. This respondent, from Gatsibo district, sold land in 2010 and now rents about 12 Ares (0.12ha) each season to produce food. She says that the biggest problem in agriculture is that she does not own land.[160] Even having a small piece of land matters.

In spite of the fact that land reforms have enabled some farmers to use land for collateral, farmers are generally cautious about losing their main resource. Instead, there is an increase in respondents who buy land. This is shown by the fact that of all the respondents who own land through purchase (46%), most (60%) bought land after 2000. However, 50% of respondents operate on the same land size as they did in 2000.

---

[159] Access to credit is discussed below in Chapter 8.
[160]Interview with FM 199.

Table 7.5: The relationship between land management and productivity with possessing a land title

Variable	Possess Land title (N=243)	No land title (N =28)	Approx. significance
Increased yield (% farmers)	69	58	0.13
Protected land from soil erosion (% farmers)	45	29	0.05*

***,**,* significant at 1%, 5% and 10% probability respectively
Source: Survey data

Using cross tabulation, Table 7.5 analyses the relationship between land titling, productivity and protecting land from soil erosion.

There is a slightly higher percentage of farmers who increased yield among those who possess land titles compared to those who do not. However, this difference in productivity between the two groups was not statistically significant. The majority of respondents in both groups say they have increased yield. Whether a farmer possesses a land title or not may not impact on productivity if they lack the knowledge and technologies to do so.[161] On the contrary, there is a significant relationship between titling and land management.

A higher percentage (45%) of respondents who have titles have protected land from soil erosion, compared to 29% among those without land titles. Land management is a long-term investment that requires resources, such as labour and financial investment. It is likely that farmers with land titles are more inclined to invest in land management compared to those with uncertain land tenure. This does not, however, disregard the fact that over decades Rwandan farmers have engaged in different methods of controlling soil erosion and improving productivity.

[161] See Chapter 6, Section 3 on barriers to technology adoption.

Figure 7.4: Photo showing soil erosion and land fragmentation

Source: Author's own

Figure 7.4 shows a typical hillside in rural Rwanda, characterised by high land fragmentation and subsistence farms on land which is prone to soil erosion. A member of a group discussion in Nyanza explained how, with land scarcity, farmers are looking for ways to increase land productivity to support their families:

> Since we can no longer fallow, we have had to find other ways of improving soil fertility. For example, when my father divided land between his children we each got a small plot of land. I needed to look after my land, reduce soil erosion and improve fertility. Then I started applying manure to produce more and sustain my family.[162]

The traditional way of increasing soil fertility is leaving land fallow for a few years. Since fallowing is impossible with the current land constraints, farmers

[162] Group GNK2.

are using other methods to improve soil health. Farmers can gauge land fertility by looking at the physical properties of the soil:

> When you see that your soil is red, then you know it lacks nutrients. The good colour is black (…). You can also tell the quality of the soil by looking at what is growing on land. When the plants on a particular land have broadleaves and are looking good then you know the land is good. When the plants are small and dwarfed then you know the soil is bad.[163]

Close to 90% of respondents use manure and most combine it with chemical fertilizers to get better yields.

> We have learnt that combining manure and inorganic fertilizers gives better crop yields.[164]

Increasingly farmers are using integrated methods to increase soil fertility. About 12% of the respondents use compost (Figure 7.5).

Making Compost by using plant material is a new concept, with none of the respondents having used the technique before 2007. Respondents without livestock, who find it difficult to make manure, appreciate composting:

> I can now say, I know how to make compost. Even without a cow, I can make compost from grass, which we used to throw away. We used to burn rice straws but now we have learnt how to use it to increase fertility. We learnt this method from an agricultural mobilizer[165] in our villages.[166]

---

[163] Group NNY1.
[164] Group NK2.
[165] Agricultural mobilizers are volunteers who support farmers at the village level. They are part of the national agricultural extension system
[166] Group GNK2.

The application of compost was particularly important among farmers who use terraces to control soil erosion. Farmers combine fertility management with soil erosion control measures. There are different methods used as a farmer in Nyanza described:

> We dig ditches along the hills, to reduce the velocity of the water. We then plant grasses around the ditches, which we call the agronomist chair [laughter]. These ditches trap water, which slowly seeps through the soil. But on hillsides with high slopes we have terraces. We did not have terraces before, because the technique was not known to us and we cultivated lower land. We now know the types of grasses that can be planted on the hillsides.[167]

Figure 7.5: Photo of water ditches along terraces

Source: Author's Own

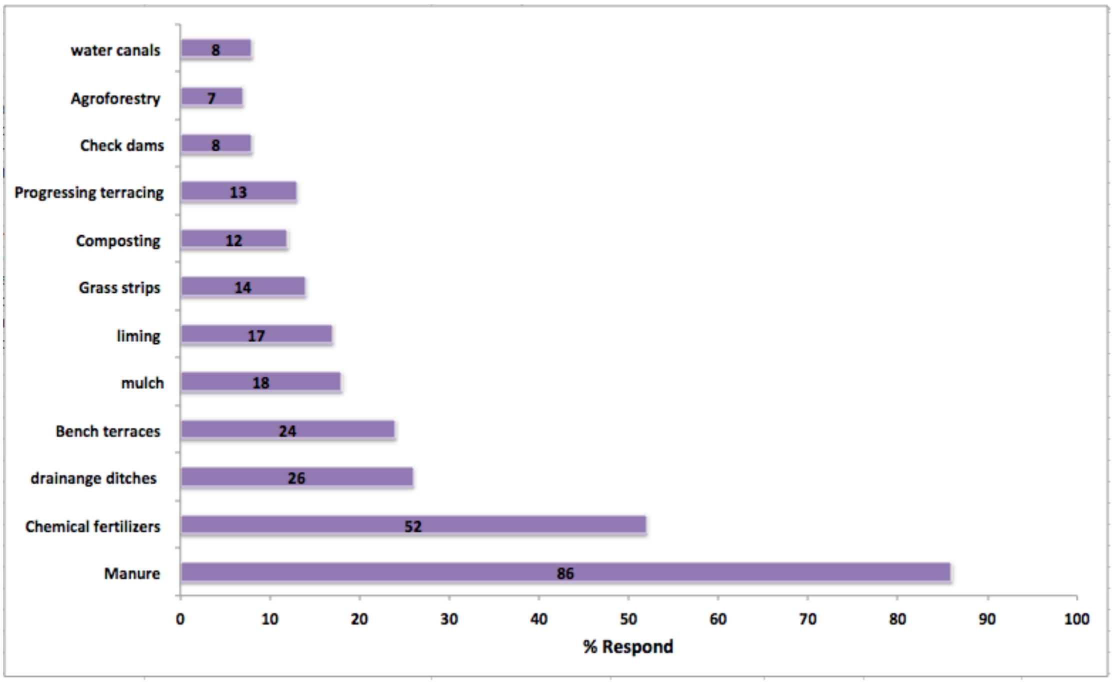
[167] Group GNN1.

About 45% of the respondents have soil erosion control structures on their land. The different methods used to improve soil fertility and control erosion are shown in Figure 7.6. The prevalent soil erosion control techniques include drainage ditches, water canals, canal check dams and terraces. Farmers also incorporate grass and tree planting within their farming systems. In addition to crop production, about 26% of the respondents have plots with forests.

Generally, there is considerable effort among farmers to improve soil management and increase productivity on their tiny pieces of land. To raise agricultural productivity sustainably and ensure more reliable food production, the government is expanding the area under irrigation to facilitate farmers' access to water.[168] As irrigation has become an essential feature of agricultural transformation, the next section explores changes that have enabled farmers to efficiently manage water to increase productivity.

[168] Chapter 2, Section 3 describes key irrigation programs.

Figure 7.6: Technologies farmers use to improve fertility and control erosion



Sources: Author's own

7.2 Increasing water use efficiency and productivity

Farmers say that planning for agricultural activities has become more challenging because of sporadic and unreliable rainfall:

> We need to master the timing for planting properly. This is because now that rainfall is unreliable, early planting could increase the chances of getting some harvest.[169]

Farmers have always been dependant on the weather, engaging in agriculture that benefits from a mixture of sun and rain. Today, the once predictable rain patterns have become unreliable, leaving farmers puzzled about the best time to start planting. Farmers with irrigation have better control over the timing of agricultural activities. As a result, these farmers are able to cultivate crops in multiple seasons and reliably increase food production. This is the reason

[169] Interview with respondent FM134.

why, as part of their agricultural transformation strategy, the government of Rwanda prioritised irrigation.

Area under irrigation has more than tripled in Rwanda, from about 11,000ha in 2006 to 48,000ha in 2018 (MINAGRI 2009b; GoR 2010). Irrigation is mainly provided by the government, but managed by users. While the government hired irrigation experts to construct the necessary irrigation infrastructure in different schemes, the management aspect of these schemes at the local level was complex. This section explores models used to manage irrigation schemes and reach the intended goal of increased productivity and resilience. The section draws from group discussions to document farmers' experiences and the progression of the current model used to manage water for agriculture.

About 7% of the respondents, mostly located in Nyanza and Gatsibo, have access to irrigation. These districts have received significant investment in irrigation because they are most prone to drought. Fortunately, these districts also have irrigable valleys that are suitable for agriculture, particularly marshlands. Marshlands are state-owned public land, some of which can be rehabilitated[170] and used for farming. Before rehabilitation, a typical marshland would be used informally by nearby communities for livestock and subsistence farming. Gatsibo farmers described the state of agriculture in their marshlands before rehabilitation by the government:

> Around 2000, I remember, there was no rice growing in this marshland, we only used a small part to grow food crops. Land in the marshland was accessible to anyone. We would slope down and mainly plant sweet potatoes, yam, or vegetables. But sometimes the marshland would flood especially during the rainy season and we could lose crops.[171]

[170] Marshland rehabilitation and development is the installation of an irrigation system, mostly canals and a water storage reservoir. Water flows to different plots by gravity.

[171] Group GGN3.

> Our cows and goats grazed in the marshland and sometimes we cultivated a few crops. Now, the whole marshland is used to produce rice. Rice is definitely better than the crops we used to grow. For example, the sweet potatoes we grew did not even go beyond the boundaries of our district sector; we mostly consumed the potatoes at home. Today, the rice we grow in this marshland is not only sold in the markets around here but it is also sold throughout the country.[172]

The description of agricultural practices given by Gatsibo farmers is typical of any marshland in the country before rehabilitation. After rehabilitation, land in marshlands is leased to farmers who are interested in commercial and cooperative farming. Infrastructure in the marshlands is mainly designed for flood irrigation, which is suitable for rice growing. Having a plot in the marshland is not only an addition to household land; it also provides access to water for agriculture. In most cases, a plot in an irrigated marshland also presents an opportunity to grow rice, considered by farmers and the government to be more profitable than the sweet potatoes, yam and vegetables originally grown in the marshlands. While giving an account of how the transition to growing rice in the marshland happened, farmers indicated that the change was not easy:

> Since we originally used the marshland, we were prioritised for land during redistribution. When the government completed the construction of water canals, local leaders encouraged us to form a cooperative. They said, that way, we would work together and our cooperative would facilitate access to inputs and markets.[173]
>
> When we started, I was allotted 20 Ares (0.2ha) in the marshland and it was my first time to grow rice. The first season we planted rice and we did not harvest much, yield was low. In the second season, yield was

---

[172] Group GGK4.
[173] Group GGG5.

still not good. The third season, no one went to the marshland. You see I did not know much about growing rice at the time and it requires a lot. I was not even among those who went for training. But what motivated me was that we could eat the rice we produced at home. We would harvest the paddy, pound it and cook it. We did not take rice to any mill at the time. As the days and season went by, we started to see the benefit of increasing yield and selling some of the rice to traders. After about 3 years we began to improve our yields, for example a farmer would get 20kgs of rice from only 1Are (0.01ha), then the next season that increased by10kgs. Each season we increased yield and today we harvest about 60kgs per Are and supply rice to the new rice mill nearby.[174]

For most families in Gatsibo, rice would have been considered a delicacy, bought from shops and eaten by a few families on special days. Although marshlands provided the opportunity for many rural communities to grow and eat rice, it required a different skill set. Not only were farmers required to use new farming methods to produce rice, they were also expected to manage the irrigation scheme. That is why they were encouraged to form cooperatives to support each other.

The new cooperatives in the marshland took on responsibility for training farmers, organising input distribution, markets and monitoring water distribution. In the long run, it became apparent that cooperatives were unable to balance all these activities and make the investment in irrigation viable. Farmers revealed that the problem was that cooperatives concentrated more on rice commercialisation, and paid limited attention to issues concerning water:

Our cooperative was the one managing water. But cooperative leadership was more concerned about making money. When they

[174] Group GGK4.

> collected water fees[175], the priority was to invest the money into other profit-generating activities. Because water infrastructure deteriorates slowly, maintenance was less likely to make it to the priority list of cooperatives.[176]
>
> We had a water committee within the cooperative and a written water schedule. Although we had a water schedule at the zone, there was limited follow up and monitoring of water distribution by the committee. As a result, distribution was not done properly and not all farmers accessed water. Since the cooperative was not managing water efficiently, there was need for another committee whose focus would be only water.[177]

The limited capacity within the cooperative to manage water led to increased conflict and reduced rice productivity. Farmers revealed the inequalities in water distribution that increased in the marshlands:

> We did not have rules to govern water distribution. When a farmer closed the canal to direct water into their plots and interrupted the set schedule, it was difficult to know what to do. Yet, they would stop water from flowing to other plots and keep people waiting. Since it was a struggle to irrigate in the day, many times we irrigated at night.[178]
>
> Water distribution becomes a big issue in this marshland. Some farmers were intimidating. Strong farmers, able to bully others, were more likely to irrigate during the day. I remember a farmer who would guard the water canal fiercely like a lion (Intare) and say, "Whoever diverts this water to their plot will see me". Farmers not able to deal

---

[175] A water fee is a sum of money given by users for operation and maintenance of the irrigation facility and canals that feed canals pipes that irrigate crops.
[176] Group GGN3.
[177] Group GNNY1.
[178] Ibid.

> with such conditions would decide to irrigate at night. Vulnerable farmers like the elderly and women who found it difficult to irrigate at night or wait for water all day, saw a decrease in yields because they were hardly able to irrigate.[179]

With increasing upheaval in irrigated marshland and declining productivity, the government had to step in. In 2012 a Ministerial order establishing Water Users Associations (WUAs) in all irrigated schemes in Rwanda was passed. Given the ongoing water challenges, farmers welcomed the WUA idea. They gave a step-by-step account of how they formed WUAs and changed the rules on water use to increase efficiency and productivity:

> We are not the ones who came up with the WUA idea. It was the technicians from MINAGRI who analysed the situation and the water problems in the marshland and come up with the suggestion of WUAs. (…) After we understood the role of WUAs, we introduced the concept to all farmers and started to choose different committees. [180]

> We were first trained on formation and functions of WUAs. After that, we were able to choose WUA leadership, starting with top management committee, which included auditors. Then we chose the committee for conflict management and procurement. We then selected leadership at the zone and small group level. The general assembly was made up of all water users. We decided that the first point of contact if a farmer has water issues would be the zone, where we have a permanent irrigator paid by the WUA. In our marshland, a zone has about 70ha. We have 9 irrigators whose job is to monitor water distribution and ensure all farmers receive water.[181]

[179] Group GNK2.
[180] Group GNNY1.
[181] Ibid.

Although the WUA model was a top down idea, once farmers received training and grasped the concept, they were able to use the idea in their different contexts to solve the water problem:

> When our WUA was established, we set rules, which every farmer was required to follow to enable equal access of water for all users. There are also set penalties for those who break the rules. When we have sufficient water, it is equally distributed to all farmers. Once the schedule is agreed upon, farmers are expected to follow it. For example, if a specific zone is scheduled to receive water, farmers in other zones are expected to direct water to that zone and not to disrupt the flow. There is a 5000Rwf (£5) fine for anyone who diverts water illegally.[182]

> At the beginning of a season, we call a meeting that includes irrigators, lead farmers and technicians[183]. During the meeting, a water schedule for the next season is developed and all the zone representatives take the message to the rest of the farmers.[184] Our water plan and schedule is hung in public places like the trading centre. Farmers receive information about the weekly water schedule, showing the day and time when each zone will irrigate. Irrigation is done by zone and water is distributed peacefully without any hassle (Indulu). This is why I think the WUAs idea is such an answer to the many wrangles in this marshland.[185]

> The WUAS were established for reasons like these. Today there is no one having sleepless nights, irrigating with a torch at night. There are no more bullies who stand at the canal and intimidate others. Everyone waits for their turn: if the WUA says water will be distributed in my zone

[182] Ibid.
[183] Irrigators are hired technicians in charge of water, while lead farmers are volunteers and farmer mobilizers.
[184] Group GGN3.
[185] Group NNY1.

> at 10:00am on Tuesday I know that is it. The water distribution schedule communicated to zone and small groups is reliable.[186]

WUAs have streamlined water distribution by setting rules and sanctions and improving communication among users. Although WUAs initially received financial support from the government,[187] most of them have increased financial stability through the collection of water fees from users. Through the WUAs, farmers develop annual Operation and Maintenance (O&M) plans and budgets that inform the decision on the amount of water fees to be paid seasonally by each farmer.

> When the WUA concept was first introduced, we did not have a proper annual plan and budget for O&M. But we agreed to start with 200Rwf/Are/season [£ 20 pence] as water fees to meet the cost of water distribution in the beginning (…). Then we asked ourselves a question, 'what would we like to achieve in the next five years?' After the question was posed to WUA general assembly, we agreed on priorities and developed a plan and budget. (…) According to the plan we were each supposed to pay about 700Rwf/Are/season [£7 per hectare] each season. But that cost was high. So we agreed to find ways of cutting costs through community work. Once some activities were done through community work, the cost reduced by more than a half and became 300Rwf/Are/season.[188]

The calculation of fees is based on the cost of O&M and paid per area irrigated. WUAs and cooperatives work together to collect the water fees from each farmer:

---

[186] Group G.
[187] Own experience: government supported the WUAs with funds to hire a manager and an accountant for a specific period of time.
[188] Group GGN3.

> Our WUA does not go collecting money from each farmer. Since we have a good working relationship with the cooperative, they deduct the money from each water user's revenue from sales and deposit it on the WUA account. The cooperative has records on the area planted and irrigated each season so they deduct water fees from each farmer accordingly.[189]

The amount of water fees collected varies from scheme to scheme according to the type of scheme, level of productivity, commercialisation and organisation among farmers (Table 7.6).

Table 7.6: Annual water fees paid by farmers in different irrigation in 2016

Group	Water Fees per farmers/ha/season (Rwf)	Areas of Marshland size (ha)	Total fees per year
Nny1	3000	140	2,400,000
NK2	2500	60	300,000
GN3	3000	950	5,700,000
GG5	2500	400	2,000,000

Source: RSSP

Looking at some schemes used by respondents, Table 7.6 shows that some WUAs handle a considerable amount of money each year. RSSP reports show that water fees collection rates are high, with more than 80% of farmers paying each year.[190]

---

[189] Group GNK2.

[190] RSSP 2012-2013 WUA progress report.

In addition to the day-to-day expenses, the WUAs use water fees for infrastructure maintenance and repair. Farmers have noticed that the WUAs' approach and response to infrastructure damage helps to prevent significant interruption of irrigation and reduced rice yields. Different groups gave an account of how WUAs tackle the issue of infrastructure maintenance and repair:

> When an irrigation infrastructure is broken, repairs are done in a timely manner before affecting water distribution. It takes about an hour for the WUA to react and start planning for repairs. The aim is that life in the marshland is not heavily disrupted. Before, when the cooperative was still in charge, a report about infrastructure damage would get to their office and take one to three months before anything was done.[191]

Figure 7.7: Photo of farmers cleaning a water canal during community work

Source: Author's own

Using water fees and the community work some groups have been able to expand the irrigated area. This is quite significant, considering that the development of a hectare of marshland costs approximately $4000 per hectare

191 Group GN4.

of land.[192] Farmers from a marshland in Nyanza say they have an expanded area for irrigation:

> There is a part of the marshland, which was not developed by the government, about 4ha. We were able to develop that area ourselves. We constructed the canals and levelled it and now about 20 households are using that part of the marshland. There is also a place that would flood, which we have now repaired. We paid money to a constructor who made the necessary repairs because that place was problematic. We work following our annual written and agreed upon plan.[39]

While some WUAs have been successful, others have not yet developed appropriate strategies to collect fees and motivate cooperation within the marshland. One group mentioned that they still have problems of canal cleaning:

> Some farmers have not yet appreciated the continuous cleaning of the water channels around their plots. For example, a farmer may come to the marshland during planting, weeding and harvesting but never appear during canal cleaning. This affects water flow from their plot to other farmers' plots. We have to continue talking to such farmers.[193]

Problems with canal cleaning were typical in irrigated marshlands around 2008 prior to WUAs.[194] One of the roles of the WUAs which is most appreciated is conflict resolution. Farmers say they have a conflict resolution mechanism that works:

> There are committees at small groups and zone level, which are responsible for conflict resolution. If I have a problem with my neighbour I take it to those committees and if they can't resolve it I am

---

[192] Own experience from managing irrigation development project.
[193] Group GNK2.
[194] Own experience working with farmers in irrigated marshlands.

> allowed to take it to another level. There are three people responsible for conflict resolution at the group level. Let's imagine, we have a leaking canal in one location and people are not agreeing to the extent of the problem. We often take mediators from the committee to help resolve the issue.[195]

The WUA model in Rwanda is complex, and relies heavily on the relationship with the cooperative. By organising access to improved seeds and fertilizers, the cooperative enables farmers to increase yield and income from which water fees can be deducted. However, the farmers say that in order for this system to work, the cooperative and WUA must have a good relationship:

> Initially it was difficult, for the WUAs and cooperative to work together. What was important was to clearly define the roles and responsibilities of each committee. Farmers also had to understand how they belong to both a cooperative and WUAs.[196]

> We needed to strengthen our leadership and relationship. In the beginning the cooperative and WUAs didn't work together. As a result, it was difficult for either of the committees to operate well.[197]

WUAs, together with the cooperatives, have supported the increased productivity of members as reported by Gatsibo farmers:

> What I can say is that being in a WUA and having access to water has changed my life. I grow rice on 20 Ares (0.2ha) and with good irrigation I have been able to increase my harvest to 1.3Tn per season.[198]

---

[195] Group GNNY1.
[196] Group GGG5.
[197] Group GNNY1.
[198] Group GGG5.

All the respondents in the irrigation schemes have access to improved seeds and chemical fertilizers and 80% say they have increased yield. This clearly shows farmers with irrigation are also likely to access other services, giving them an edge in increasing productivity. But those who have access to irrigation are very few (7% of respondents). The next section analyses factors that influence increased productivity for farmers.

7.3 Factors that influence increased crop yield for farmers.

During the survey, farmers were asked, 'Do you harvest more from your land today compared to [15 years ago]?' Farmers gave a yes or no response to this question, with some giving reasons for their answer. The response to this question was used as an indicator of increased productivity. Farmers attributed yield increases to more knowledge, timely planting, adequate rainfall, improved seeds, chemical fertilizers, and manure. Some of the anecdotal factors are included in a statistical analysis undertaken to examine determinants of increased yield among farmers (Table 7.7).

The objective of the statistical analysis was to understand the relationship between a set of socioeconomic, institutional and technological factors, and increasing yield. The model showing the expected trends and relationship between the dependant and independent variables is elaborated in the methodology chapter.[199] Since the dependant variable is a yes and no answer to whether a farmer increased yield or not, a binary logistic model was employed.[200] The logistic regression model is used to explore the relationship between the dependant variable and the independent variables.

The dependant variable is binary with 1 if a farmer increased yield and 0 if not. Fifteen independent variables, most of which have already been highlighted as important for productivity in this and previous chapters, are

---

[199] Chapter 4 section presents the the logistic regression model used to analyse the factors that affect increased productivity.
[200] Chapter 4, Section 4 presents the general regression model.

selected. These independent variables are: farmers' age, household size, education, land size, use of improved seeds and chemical fertilizers, manure application, monocropping and line planting, membership of a small farmers association, membership of a cooperative, access to extension services, and whether a farmer has protected their land from soil erosion. Each of these variables is discussed further in the following paragraphs to highlight the rational for their inclusion in the model.

Age is an important factor in agricultural productivity. Sections 7.1 and 5.2 of this thesis indicate that age affects farmers' access to resources and the ability to engage in intensive farming. As young farmers grow older, they gain farming experience and increase the stock of resources (including land, labour, finances and technologies) required for lucrative farming. However, the quantity of resources and physical ability of the farmer to actively engage in agriculture activities reduces as farmers reach an advanced age. Therefore, elderly farmers may be less enthusiastic about adopting new technologies (Alexander and Mellor 2005).

Although **Gender** was not statistically significant, Chapter 5 shows that women were more likely to adopt new technology than men. Some studies have found that Gender differences in productivity are linked to access to resources like land, technologies, and finances (Girma et al. 2019).

Household size can have influence on the land use patterns farmers employ (James 2014). Big families are more likely to engage in intensive agricultural systems while smaller ones use extensive measures. This is related to the fact that most smallholder subsistence households depend on family labour for agriculture, which may have an impact on the type of farming systems used. In a situation where land is limited and output is low having a large household could mean that all the food us consumed. The lack of income from farming may lead to poverty and reduced productivity (Omideyi AK 1988). The positive relationship between household size and technology use in Table 7.7 implies that, larger households are more likely to use improved seeds and fertilizers.

Therefore, a positive association between levels of household labour and agricultural yield can be expected (Ninan 1984).

Exposure to **formal education** may increase farmers' ability to process information about the use of productive agricultural technologies (Kaliba, Verkuijl, and Mwangi 2000). Having attained some level of formal education may increase the ability to understand the relevancy and the application of new and productive forms of farming, improving the chances of increasing land productivity.

The debate on the relationship between **land size** and productivity is a recurrent one (Helfand and Taylor 2017). Proponents for small farms argue that because small farms have better technical efficiency, they have higher productivity compared to big farms; hence, the concept of an inverse relationship between land size and productivity (Saini 1971).· Other studies have rejected this notion, saying the difference in productivity between the small and big farms reduces with advances in technology (Bagi 1987). It is important to keep in mind that in this study, all farmers operate on land that fits in the category of smallholdings (average land size is 0.5ha).

Farmers who use **improved seed, fertilizer and manure** are expected to improve crop yield. That is why intensification policy promotes the use of these inputs for agricultural transformation. More than half of the respondents were found to use improved seeds and fertilizers.[201] Although the study does not establish the extent to which each farmer uses these inputs, it is expected that farmers who use improved seeds and fertilizers also increase yield.

Monocropping and line planting are practices promoted together with the use of improved seeds and fertilizers in CIP. This study shows that there is a shift from mixed cropping and broad casting to monocropping and planting

---

[201] Chapter 6, Section 2 of this thesis discusses the different techniques farmers use to grow food.

seed in lines. This research shows that this approach is widely used by farmers including those who have not adopted the use of improved seeds and fertilizers.[202] Nonetheless, the strong association of monocropping and line planting with the use of improved seeds and fertilizers[203] is likely to lead to increased productivity.

Farmers' organisations are seen as important instruments for agricultural transformation. Chapter 8 discusses collective action at the grassroots in detail and shows that, farmers become members of cooperatives and small associations to improve peer learning, access to inputs, finance, and markets. Farmers' organisations in general tend to provide farmers with the social capital, services and technologies needed to improve farming. Considering their important role, farming cooperatives and association are included in the analysis. It is expected that membership of a cooperative and farmers' association would increase the probability of increasing productivity.

Extension agents facilitate farmers' access to information and skills needed to increase land productivity. Farmers visited and supported by extension agents are more likely to increase yield compared to those who are not. As already discussed extension services had the greatest influence on technology adoption.[204] On the other hand, extension agents who do not believe in the use of convectional agricultural technologies may inhibit radical productivity increases.

Commercialisation is considered to be an important driver of intensification and increased agricultural output. Farmers who earn more from agriculture are likely to invest in improved seeds and fertilizers.[205] With the use of improved inputs, farmers are expected to increase output and increase

---

[202] Ibid.
[203] See the significant relationship between monocropping and line planting and the use of improved seeds and fertilizers in table 6.7 Chapter 6
[204] Ibid
[205] See Chapter 6 Section 4 shows the statistical analysis of factors influencing the adoption improved seeds and fertilizers

surplus for the market. On the other hand, access to markets also motivates increased agricultural output.

Farmers have **adopted a range of soil erosion control techniques** (Figure 7.6). Since these techniques are valuable for water and soil control, they help improves soil quality(Clay and Lewis 1990). It is possible that farmers who invest in erosion control also improve soil fertility and productivity.

The effect of the different independent variables on the dependent variable (increasing yield) is summarised in Table 7.7, which shows the results of the logistic regression analysis.

Results show that age, household size, use of improved seeds and chemical fertilizers, access to extension services, and commercialisation had a significant correlation with increasing productivity. In contrast, formal education, land size, line planting, monocropping, use of manure, membership of a small farmers association, cooperative membership, and soil erosion control did not have a significant effect on increasing yield. Each relationship is discussed starting with variables that have no significant effect on increasing productivity.

Table 7.7: Results of the statistical analysis showing factors that affect agricultural productivity

Independent variable	B Coefficient	S.E.	Wald	df	Sig.	Exp(B)
Age	-0.025	0.011	5.251	1	0.022*	.976
Gender	0.042	0.321	0.017	1	0.895	1.043
Household size	0.176	0.072	6.021	1	0.014*	1.192
Formal education	0.371	0.317	1.368	1	0.242	1.450
Land size	-0.093	0.124	0.557	1	0.455	.911
Access to extension services	1.030	0.345	8.902	1	0.003*	2.802
Membership to a cooperative	0.537	0.486	1.218	1	0.270	1.710
Membership to Farmers' association	0.096	0.517	0.034	1	0.853	1.100
Mono cropping and line planting	0.059	0.371	0.025	1	0.873	1.061
Commercialisation	0.547	0.327	2.795	1	0.095*	1.728
Use of improved seeds and fertilizers	0.691	0.371	3.471	1	0.062*	1.995
Use of manure	0.329	0.407	0.653	1	0.419	1.389
Land protection against soil erosion	0.444	0.324	1.884	1	0.170	1.559
Constant	-1.093	1.019	1.149	1	0.284	0.335

***, **, * significant at 1%, 5%, 10% probability respectively

As for technology adoption, **Gender** has a positive relationship with increasing productivity. Although this relationship was not found statistically significant, it suggests that women are more likely to intensify measures to increase crop yield than men. This could be linked to government efforts to promote equal access to resources for both men and women. The result suggests that when women have access to resources, they may make a greater contribution to food production than men.

Formal education has no significant statistical association with increasing productivity but it has a positive relationship. The positive relationship implies that farmers with formal education are more likely to increase productivity. However, the lack of statistical significance may suggest that formal education does not equip people to become better farmers. On the other hand, in a situation like Rwanda where there are no language barriers (Kinyarwanda is national language used in all districts) and a strong extension system, learning about new technologies may not demand formal education.

The use of **line planting and monocropping planting** did not have a significant impact on increasing productivity. This result differs from the results shown in chapter 5, which shows that farmers who engage in line planting and monocropping planting were highly likely to adopt improved seeds and fertilizers. Although line planting and monocropping planting are promoted together with the use of improved seeds and chemical fertilizers, these techniques are widely used by farmers. About 77% and 66% of the respondents in this study engage in monocropping and line planting, respectively. It is likely that in conditions where soils are impoverished, using monocropping and line planting, without addressing the issue of fertility may not lead to increased yield.

Membership of **farmers' associations and cooperatives** was not found statistically related to increased productivity. However, the positive relationship indicates that being a member of these organisations increases the probability of increasing yield. Considering that membership of a cooperative is strongly linked to the technology adoption it is surprising that it has no statistical significance to increasing yield. [206] Cooperatives will be extensively discussed in Chapter 8. The results show that using cooperatives as conduits for input distribution does not necessarily guarantee that farmers will increase yield. Cooperative members have to use the inputs and engage in practices that raise productivity.

[206] ibid

Interestingly, **land size** did not have a significant effect on productivity either. This may be because there is a limited variation in landholdings among farmers since respondents generally have very small plots. However, the negative coefficient of these variables suggests an inverse relationship between land size and productivity. This denotes that as land size reduces, farmers are more likely to intensify production. The finding is contrary to results in Figure 6.7 that showed that farmers with relatively small land were not likely to use improved seeds and chemical fertilizers. Although this study does not measure the level of yield increase, the result suggests that farmers with small pieces of land can intensify production through other techniques, e.g use of manure, mulch, compost e.t.c.

Soil erosion control was not associated with increasing productivity. As you may recall (Figure 7.7), farmers use several measures to protect land from soil erosion including planting trees, contour ditches, check dams, progressive terracing, and radical terracing. About 45% of farmers have soil erosion infrastructure in their plots. While the infrastructure helps to reduce soil erosion, it does not inevitably lead to increased soil fertility and productivity. Farmers have to engage in fertility measures in order to increase productivity. For instance, the majority of farmers (72%) who have radical terraces were also able to increase yield because in most cases terrace construction involves a fertility package (manure and chemical fertilizers for the first season) used to restore the soils.

Age had a negative and significant effect on increasing productivity. This indicates that younger farmers are more likely to increase productivity compared to the elderly. Increasing land productivity is a labour and capital-intensive venture. Yet these resources may be limited among elderly farmers.[207] In addition, people tend to become more risk averse, as they grow older, making the adoption of new technologies harder (Adesina and Zinnah

[207] Figure 7.2 of this chapter and Chapter 5 Section 3 highlight the relationship of age and land and labour

1993). Generally, younger farmers have the physical capacity to observe the timing of the various agricultural activities required to increased productivity, whereas older farmers that are becoming frail often find this harder. For instance, an 87-year old farmer from Musanze said he could no longer keep up with all the farming activities:

> Those who are younger and still have the energy are able to cultivate on time, use fertilizers and increase crop yield for sure. As for me, I am getting old and have limited energy to keep up with the timing of all these farming activities.[208]

Farmers in a similar situation affirmed this by saying that, at a later age; people pass on some of their limited land to their children:

> I am old and life is getting worse because I have given my land to my children and remain with only a small piece.[209]

As farmers grow older, resources shrink, and some talk about the effect of a decrease in the availability of family labour:

> My life is getting worse as my children who helped on the farm and contributed to household income are getting married[210].

The inverse relationship of age and increase productivity was also highlighted by Guo, Wen, and Zhu (2015). They show the significant effect of age on agricultural production and that elderly farmers are more likely to give up farming than their younger counterparts.

Household size has a positive and significant relationship with increasing productivity. It can be inferred from the result that the larger the family, the

[208] Interview FM24.
[209] Interview FM116.
[210] Interview FM32.

more likely the household is to increase yield. This is because smallholder farmers depend on their household as a source of labour. For instance, in 2016, the majority (66%) of the respondents used only family labour while 34% used both family and paid labour for agricultural activities. The larger the family the more labour that is available meaning it is more likely that farmers will achieve timely planting and weeding and perform other activities important for increasing productivity. The other advantage is that family labour is easily accessible compared to hired labour, which is often scarce and expensive during the peak crop cycles (planting and harvesting time). Also, bigger households require more food, which may motivate use of intensified production systems on the small land available to sustain the family. These results are in line with the findings of Adikwu (2014) who show that households with larger family members engage more in intensive farming compared to smaller households.

As expected, **the use of improved seeds and fertilizers** significantly increased the likelihood of increasing productivity. Although the model does not measure the intensity of use, adoption of improved seeds and fertilizers has been found to be necessary in order to improve productivity. According to farmers the use of better inputs has been the biggest driver of increased productivity:

> Before, I never knew about fertilizers and I used whatever seed was available. Land productivity was low; we could hardly harvest enough food to eat. Now, with the new inputs, we even have extra produce to take to the market.[211]

Chemical fertilizers and improved seeds become widely available in rural areas after the launch of the CIP program. As shown in Chapter 5 most farmers had never used these inputs before. The result is a signal that this policy is achieving the intended aim of improving crop yields.

---

[211] Interview with FM16.

Although most farmers combine manure with chemical fertilizers, the use of manure did not have a significant effect on increased productivity. Firstly, the benefits of manure are gradual which makes it harder for farmers to notice the impact. Secondly, almost all farmers (86%) apply some manure in the land as part of traditional practice. However, as a farmer in Musanze commented, the quality and quantity applied may not be sufficient to stimulate increased yields:

> Many times, the manure we apply is not sufficient. I think we should be trained on how to make good manure and how to estimate the amount required per plot.[212]

Although this research does not analyse the amount and quality of inputs used per farmer, these factors can have a significant impact on output. Extension agents are meant to convey information about input availability, recommended use and quality to farmers.

Access to extension services was found strongly correlated to agricultural productivity. Extension agents are the gateway to the information and knowledge required to improve land productivity. Once farmers have the appropriate information, knowledge and access to the right technologies they are more likely to increase their output.

A sector extension agent in Nyanza highlighted the importance of recognising farmers as experts and tapping into the knowledge that exists within rural communities:

> Many times farmers have information about what works best. They may not share what they know during public meetings and discussions. For example, if farmers are not confident about a new idea, you will know because no one will adopt it. It is important to create an environment

[212] Interview with FM 285.

> that makes farmers comfortable to freely share information and knowledge. Somehow, new knowledge has to fit within the local context. I have found that it is more effective to link new knowledge with the information that already exists among farmers. We should avoid saying 'I know better'. We should never forget that farmers might know better than us. [213]

Extension agents use different approaches to effect changes that impact positively on farming. Farmers who access extension services are more likely to adopt high yielding seeds and fertilizers[214] and improve productivity compared to those who do not. Access to knowledge gives farmers the ability to improve on what they already know. With increased knowledge farmers are then able to take advantage of the different opportunities. A farmer talked about how an increase in knowledge provides insight into the existing opportunities:

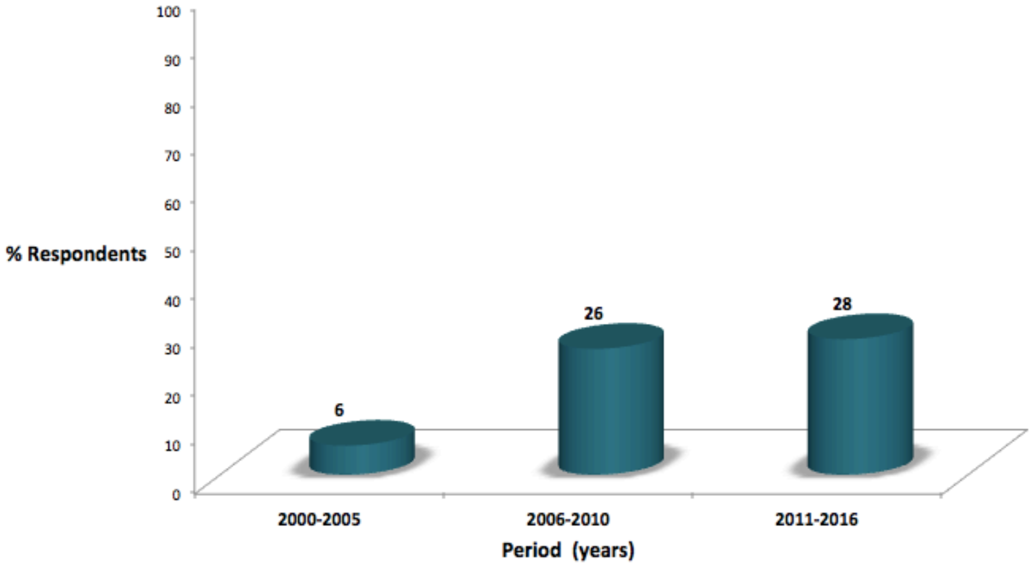
> Life is better because we now have more knowledge, even farmers with no land can rent it. Now, although I don't grow bananas, I buy them on the market and make beer for sale.[215]

About 60% of the respondents had a visit from an extension agent in 2016, compared to only 6% before 2006 (Figure 7.8). There is a 10-fold increase in the percentage of farmers accessing extension services over the period of the study. This is mirrored in the upsurge of farmers using improved seeds and fertilizers after 2006. It is these changes in technology and institutional arrangements, driven by CIP, that have facilitated increases in productivity for farmers.

---

[213] Interview with agronomist in Nyanza.
[214] Chapter 6, Section 3 shows the period when farmers started to use improved seeds and fertilizers.
[215] Interview with FM43.

Figure 7.8: The period in which farmers started to access extension services



Source:

Source: Survey data

Commercialisation has a significant relationship with productivity. Other studies have shown the strong link between Commercialisation crop productivity (Ochieng et al. 2016). Access to markets has the potential to increase utilisation of the improved inputs required to increase crop yield. Therefore, government policy aims to promote increases in both productivity and commercialisation among farmers. There is an assumption that as farmers specialise in specific crops and increase yield, they are able to sell what they produce to buy what they need for food.

7.4 Summary

Farmers underline land scarcity and unreliable weather as the key challenges to food production. Very few (7%) farmers have access to irrigation water and many operate on small plots (the average land holding per household is less than 0.5ha). Despite these limitations, this chapter consolidates evidence which shows that the recent policies have had a positive impact on land tenure security and management, water use and management and food production.

Close to 90% respondents have land titles with a 99 years lease, of these 86% say land registration has increased tenure security. This is expected in a country like Rwanda where there was potential property threat because of the history of conflict and migration. The provision of tenure is a classic type of institutional reform that significantly reduces the transactions costs associated with agriculture, as it provides a strong sense of ownership in each household (North, 1990). By formalising land ownership through the current land policy, the resultant increased security for land owning farmers has encouraged investment, facilitated agricultural change through collective action and had a secondary benefit to those who do not own land. It has also facilitated the growth of local markets, a crucial requirement in communities which have suffered from poorly functional markets in earlier times (Kirsten, et. al. 2009) and they are now much more able to rent or borrow land from farmers who are secure enough in their legal ownership to allow this.

My research finds no traces of land confiscation by the government because of failure to adopt the CIP prioritised crops, as highlighted by Huggins (2017); Dawson, et al (2016); and Pritchard (2013). These authors state that farmers are being forced to grow government-prioritised crops and fear their land will be confiscated by the government if they do not comply. As evidenced in this chapter, although many (49%) had not adopted any agricultural approaches promoted by the government, none reported land confiscation or grabbing by the Elite. Additionally, when asked about issues concerning land, only 9% of respondents mentioned issues related to land ownership, some have legal issues concerning ownership while others have experienced delays in acquiring titles. This gives me a reason to think that these households have not yet achieved the security that comes with ownership, and that the institutional reform is likely to see greater benefits only once these local challenges of land and ownership have been ironed out. I would argue that the concerns of Dawson, et al (2016); and Pritchard (2013) about the land registration policy are hasty, and do not take into account the evolutionary nature of institutional change, where early movers are followed by other members of the community as information asymmetries reduces and they are able to gain the benefits of secure land tenure. The examples of those farmers who were successful in having land titles indicate that they have an increased sense of feeling settled. A comprehensive study on the land tenure policy that analyses the entire duration of the programme has to be conducted before any comprehensive conclusion can be drawn.

Very few farmers (2%) had used land titles for collateral, and only 12% increased long-time investment. This is consistent with previous studies (see for example, Payne (2008) who show that farmers are hesitant to use the land as collateral for fear of losing their main source of livelihood. However, land titling seems to have incentivized investment, particularly in soil erosion infrastructure (Moronha, 1985). Farmers with land titles were more likely to engage in land management measures. With the challenging terrain in Rwanda and climate change, soil and water management have to go hand in hand.

One way to inspire water management in irrigation schemes is to introduce WUAs (Easter and Zekri 2004). The WUA approach involves delegating water management to users. The unique model discussed in this chapter is one where the government, Water Users Associations, and cooperatives enter into a partnership to manage irrigation schemes. Using the WUA model, farmers have managed to improved access to water and O&M of irrigation infrastructure, particularly within government-owned marshlands. The success of this model can be attributed to improved communication, clear definition of roles, transparency, and active participation of farmers organised in small groups within the Water Users Association. Farmers say this model has led to better water distribution, efficient collection of water fees, reduce conflict, and increased productivity. The value of the WUA in terms of policy success lies not so much in the water itself, although this is central for agriculture, but in creating an institution that forges a form of collective action in the villages (Ostrom, 1990). These cooperatives work to create and build horizontal coordination (Poulton, 2009), which is necessary for sustainable coordination of development policy, as agricultural strategies develop further.

A statistical analysis shows that age, household size, access to inputs, commercialisation and access to extension services were closely linked to increased productivity. Similar to technology adoption, access to extension services was found to have the most significant impact on land productivity. This contradicts Udry (2019), who finds that although extension services encourage farmers to adopt new practices, they have a limited impact on increasing yields. Yield increases may be undermined by a lack of relevant technology, soil types, and the weather. In the case of Rwanda, the provision of advisory services and inputs as a package gives farmers the prospects of hearing about the new technologies and seeing the potential by experimenting. The findings in this chapter suggest that the CIP model that facilitates access to information, markets and encourage collective action, have the potential to achieve the intended goal of increasing productivity for farmers. The next chapter explores several forms of collective action that have played a decisive role in agriculture.

Chapter 8: Enablers of Change – Collective Action and the Interaction of Key Players

Successful smallholder agricultural transformation depends on the ability of millions of small farming households to increase output, access markets, and earn more money. This process requires resources and organisation at many levels. During my research, policymakers and farmers frequently mentioned the term 'working together' when describing how they operate.[216] This chapter examines why collective action was preferred and how it is displayed at the national and grassroots levels. It examines the different forms of interaction between the state, donors, private sector, and farmers to understand the impact on agriculture. The chapter also analyses factors that influence agricultural commercialisation among rural farmers. Information in this chapter is drawn from the farmers' survey and interviews with different stakeholders.

This chapter is in 3 sections. Section 8.1 assesses collective action at the grassroots. It identifies organisations to which farmers belong; examines reasons why they become members; and examines the impact of membership on farming activities. Section 8.2 Identifies factors that affect farmers' participation in produce markets. Section 8.3 examines collective action at a higher level between the government and donors highlighting changes in their relationships over the period of the study. The section shows the interaction between the government and private through a step-by-step account of building the current fertilizer distribution system from the beginning.

8.1 Why smallholder farmers choose collective action

Traditional agriculture is characterised by individualistic subsistence farming systems that focus on food production for home consumption. In this system,

---

[216] Chapters 5, 6, and 7 discuss different forms of collective action

smallholders make day-to-day decisions with minimal influence from fellow farmers, the state or market. Agricultural transformation aims to facilitate a shift from subsistence to more market-oriented systems. Considering that individual farmers have many constraints, including limited land, information, knowledge, technologies, finances, and markets, the government encourages collective action to facilitate inclusiveness and efficient policy delivery. This section analyses the different forms of collective action at grassroots, the reasons why smallholder farmers join groups, and find a nexus between membership to these groups and agricultural production.

While collective action at the community level is encouraged for agriculture transformation, its institutional form varies by location, and farmers might be members of more than one collective body. Seventy three percent (211) of interviewees/respondents were found to be members of at least a farmers' association (FA), farming cooperative (FC), small savings group (SG), Savings and Credit Cooperative (SACCO)[217] or Water Users Association (WUAs).[218]

Table 8.1: Respondents and the organisation they belong to

Organisation	Respondent (%)	Men (%)	Women (%)
Farmers' Cooperative (FC)	18	62	38
Farmers' Association (FA)	10	29	71
Savings group (SG)	51	38	62
Saving and Credit Cooperative (SACCO)	36	49	51

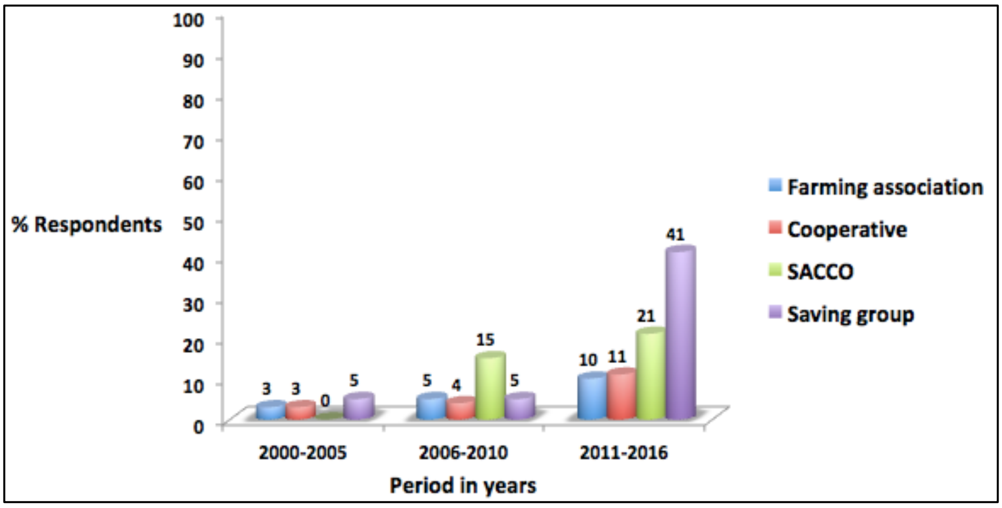
Source: Survey data
Note: Some farmers are in more than one organisation

[217] SACCOs are legal institutions registered under RCA and the Cooperative Act 1996, but are supervised by the National Bank of Rwanda. They started in 2009 with the aim of increasing financial inclusion.
[218] Since WUAs were discussed in Chapter 6, they are excluded from this chapter. Further discussion on the role of these groups is found in the sections below.

Most farmers belong to groups that promote saving and credit: 51% belong to a SG and 36% to a SACCO (Table 8.1). Fewer (18%) belong to FCs and FAs (10%). The majority of respondents (more than 80%) are simply members of these organisations, holding no leadership positions. Table 8.1 shows that generally there are more women in small and informal groups (FAs, SGs) compared to those in bigger and formal[219] government supported groups (FAs, SACCOs). Most farmers joined these organisations after 2010 (Figure 8.1).

Figure 8.1 shows that less than 10% of respondents belonged to any farmers' organisation before 2006 which suggests that before the government reforms, farmers conducted agricultural activities more individually. Following the cooperative and CIP policy (After 2006), sharp increases in membership to farmers' organisations were observed.

Figure 8.1: The period in which farmers become members of FA, FCs, SGs and SACCOs



Source: Survey data

The trends in Figure 8.1 show that increasingly farmers are moving towards more collective action through farming and financial grassroots organisations.

[219] The government regulates cooperatives but not small groups.

Reasons why farmers become members of farming associations and cooperatives

Prior to the reforms farmers' cooperatives were found mainly in cash crop production(GoR 2004). During discussions, farmers confirmed that before 2000 agricultural activities were more individualistic:

> Before, we worked individually, everyone planning his or her own activities. But now, we work together in groups, we are more organised in our farming activities. We decide tighter what to grow and each one tries to get a good harvest from their plot.[220]

According to this statement, farmers' organisations (FAs and FCs) help in planning and coordination of activities. Members of farmers' organisations make joint decisions that affect how and when individuals use land. However, the performance of a group depends on how hard individuals work on their plots.

Since, cooperatives were strongly endorsed by the government, extension agents, local leaders, and government officials were the key sources of information about farmers' organisation. In some cases, cooperative formation was farmers' own initiative.

Cooperatives are formal institutions regulated by the Rwanda Cooperative Agency (RCA).[221] They can have a large membership compared to FAs.[222] FAs are small, formed by farmers who live or farm near each other. In both FAs and FCs, members jointly define internal rules of engagement including what to grow, techniques to be used and how to organise marketing (this is particularly the case for cooperatives). Group members earmark land that

[220] Group GGK4.
[221] The cooperative policy is discussed in Chapter 2, Section 3.
[222] Cooperatives can have thousands of members while farmers' associations often have less than 50 members.

becomes part of the agreed plan. While FAs tend to operate more informally, each FC has to be registered with RCA to attain its legal status. In addition, joining a FC involves a one-time membership fee while FAs have no initial financial requirement.

Collective action was mentioned in the first National Poverty Reduction program as an approach to initiate communal discussion, encourage community led problem solving, and facilitate implementation of development activities (GoR 2002). Given the history of ethnic discrimination and the genocide, it was anticipated that collective action would foster trust and create stronger and more productive communities. Cooperatives were also encouraged as a way of facilitating commercialisation among rural farmers. Given that collective action was encouraged by the government, it is interesting to know farmers motivation to group formation.

Table 8.2: Farmers' motivations for joining Farmers' association and Cooperative

Farmer's expectations	% Respondents
Farmers association	
Work together and learn from each other	61
Access training	18
Access improved seeds and fertilizers	25
Save	11
Access credit	7
Cooperative	
Work together and learn from each other,	46
Access to training	7
Access improved seeds and fertilizers	29
Save and Credit	21
Friendship	3
Market	29

Note: Although farmers were required to give one main reason for joining a farmers' association or cooperative, some gave more than one response.
Source: Survey data

One of the survey questions asked farmers why they became members of farmers' organisations (see Appendix IV Survey Questionnaire page 348). Table 8.2 lists farmers' incentives for becoming members of farmers' associations and cooperatives.

Although agronomists, local leaders, and government officials encourage collective action, farmers make their own rational judgment when it comes to becoming members of any group. Farmers become members of associations and cooperatives to learn better farming methods, access inputs, finance, and market. There are some who join farmers' organisations to gain friendships. However, the majority of farmers became members of these groups to work together and learn from each other. For many, working together and peer-learning became essential when new methods of farming that required a different skill set were introduced.

Since farmers' organisations, particularly cooperatives, were channels of input distribution, becoming a group member increased the likelihood of accessing the CIP package (seeds and fertilizers and training). The farmer-to-farmer extension model used meant that information delivered by extension agents was transmitted to different groups through a network of lead farmers. Access to seeds and fertilizers was more complex and required coordination and organisation.

Each season, agrodealers need information about the seed and fertilizer requirement for each village. Since it is difficult for agrodealers to approach each individual farmer, they often contact the local leaders or sector agronomists. This initiates discussion among farmers and leaders who would normally not engage in each other's agricultural matters. As a result, farmers groups are formed to better coordinate input delivery, as such one of the motivations to become group members was access to seeds and fertilizers.

Farmers also become members of FAs and FCs with the expectation of saving and accessing credit. In some cases, saving and credit may be one of the goals of the farmers' organisation, which may attract farmers interested in saving and credit (Table 8.2). In other cases, increased saving and credit may be a by-product of increased yield and commercialisation by members of the groups. In general, farmers' social aspirations of becoming group members were as important as the technical and socioeconomic aspects. A statistical analysis is conducted to determine the connection between farmers' aspirations and becoming a member of a group (Table 8.3).

Cross tabulation with Chi Square and a t-test analysis were the analytical tools used to test the statistical relationship between membership to FAs and FCs, and different socioeconomic and institutional variables. Based on farmers' narratives in this and previous chapters, variables chosen include: gender, age, land size, extension services, training, inputs, markets, credit, saving and productivity. Some of the variables are drawn from the list of expectations in Table 8.2. Since cross tabulation only tests for the association between categorical variables, a t-test was run to compare age and land size between 2 groups. The results of the analysis are shown in Tables 8.3 and 8.4.

Table 8.3: The connection between FA membership and different socioeconomic and institutional variables

Variables		FA Members N= 28	Non FA members N=260	Chi-Square (X^2)	t	Df	Sig
Gender (%)	M	29	38				
	F	71	62	0.978	-	1	0.686
Average age (years)		50	47	-	-1.213	286	0.686
Average land size (ha)		0.45	0.50	-	-0.686	286	0.754
Access extension services (%)		75	59	2.637	-	1	0.075*
Access to training (%)		32	20	2.298	-	1	0.105
Use improved seeds & fertilizers inputs (%)		67	52	2.242	-	1	0.097*
Increased yield (%)		75	66	0.875	-	1	0.234
Sold produce in 2016 (%)		57	67	1.266	-	1	0.179
Have savings (%)		39	48	0.784	-	1	0.247
Access credit (%)		7	21	2.894	-	1	0.065*

***,**,* significant at 1%, 5% and 10% probability respectively

Note: No R^2 for age and land because Cross tabulation only done for categorical variables

Source: Survey data

Table 8.4: Relationship between FC membership and different socioeconomic factors and institutional variables

Variables (% Respondents)		FC Members N= 52	Non FC members N=236	Chi square (X^2)	t	Df	Sig
Gender (%)	M	68	32				
	F	43	57	12.125	-	1	0.001**
Average Age (years)		47	46	-	0.33	286	0.149
Average Land size (ha)		0.77	0 .44	-	1.641	286	0.323
Access to extension services (%)		88	54	22.483	-	1	0.000***
Access to training (%)		48	14	32.570	-	1	0.000***
Access to improved seeds and fertilizers (%)		88	44	35.704	-	1	0.000***
Increased yield (%)		88	62	14.375	-	1	0.000***
Sold produce 2017 (%)		95	60	25.918	-	1	0.000***
% with Savings		79	39	30.229	-		0.000***
Access to credit (%)		41	14	23.158	-	1	0.000***

***,**,* significant at 1%, 5% and 10% probability respectively
Note: No R^2 for age and land because Cross tabulation only done for categorical variables

Results in Tables 8.3 and 8.4 show that there is no significant difference in age between members of FAs or FCs and non-members. Likewise, the average land size was not significantly different between members and non-members of the two groups. However, cooperative members have larger pieces of land compared to small farmers' associations. All the other variables showed a strong association between membership to a farmers' association or a cooperative.

The variables found to be related to both FAs and FCs were: access to extension services, use of improved seeds and fertilizers, and credit. Additionally, FCs were significantly linked to and gender, access to training, saving, increased productivity, and commercialisations.

While no substantial difference in gender representation between FA members and non-members, FAs have more women members than men. In contrast, the majority (68%) of FC members are men, which indicates a significant gender disparity between FC members and non-members. Barriers such lack of resources, socioeconomic norms and women's work overload may prevent women's involvement in formal organisations like cooperatives (Kaaria et al. 2016) Strict meeting obligations associated with FCs may be burdensome in terms of time, for women who are already overloaded with both agricultural and domestic duties. The requirement of entry fees could also be a limiting factor for women and poor farmers. As described by Gatsibo farmers, obtaining membership fees for cooperative membership can be challenging:

> We were about 50 farmers when we formed our cooperative [the cooperative now has 2000 members]. At that time, we had support from World Food Program (WFP). Because most of us were poor, WFP paid us food for work for levelling this marshland. In fact, most of us sold our food to get membership fees to the cooperative. Each farmer was required to pay about 3,730Rwf (£3.73) to join the cooperative.[223]

Almost all (95%) cooperative members participate in produce markets compared to half of members of FAs. This is not surprising as FCs are known as commercial organisations and farmers become members with the expectation of accessing markets (Table 8.2). Cooperatives are a legal entity, which makes them more equipped[224] to enter into various trade deals. Additionally, the results show that FC members have bigger land (average land size is 0.77ha) making them more able to generate a marketable surplus compared to non-members with smaller land (average land size is 0.44ha).

The difference in land area between FC members and non-members could be explained by the fact that in most cases cooperatives have access to public land, which they use in addition to personal land. For instance, FC members in rice cooperatives use government irrigation marshlands where a farmer is

---

[223] Group GGN3.
[224] Cooperatives are targeted for training in business management and have structures that support trade.

given at least 0.2ha (this land is leased to farmers for at least 30 years). This difference in land gives FC members the ability to engage in more market-oriented crops. Additionally, since land size increases with fragmentation, farmers with many plots can afford to register some within a cooperative while farmers with fewer plots have limited choices. Members of FAs who have smaller land (average land size 0.46ha) compared to FCs may have limited output and commercialisation.

A higher proportion of farmers in FC and FA use improved seeds and fertilizers, and access extension services compared to non-members. This shows the strong link between these organisations and CIP. Being in groups reduces transaction costs of distilling inputs and providing other services to farmers. Similar to results in chapter 6 that showed a positive relationship between cooperatives and increasing yield, this section shows a strong association between cooperative and increasing yield.

Farming cooperatives were found to be more instrumental in facilitating saving and credit. For instance, close to 80% of respondents in FCs have savings compared to almost 40% among non-members. Likewise, a higher percentage (41%) of FC members accessed credit compared to only 14% of non-members. Cooperative members have the advantage of better markets, enhancing the chances of earning more money and the ability to save. Additionally, as legal entities, cooperatives can access loans from banks, which can be extended to members. In contrast, the results show that fewer FA members are able to save and access credit compared to non-members. Since we already saw that FAs are composed of mostly women with smaller pieces of land, it is an indication that most FA members are poor with limited capacity to save or access credit.

Grassroots financial organisations

SACCOs and saving groups (SGs) are grassroots institutions that provide financial services to rural and poor communities.

Table 8.5: Respondents' highest expenses in 2016

Table 8.5: Respondents' highest expenses in 2016

Highest expense 2016 (N=219)	% Farmers
Food	39
House construction and repair	16
Seeds and chemical fertilizers	14
Children's education	12
Hospital bills and health insurance	9
Family functions	5
Buying livestock	4
Business	1

Source: survey data

About 66% of respondents were found belonging to either SGs or SACCOs, and 36% to both. These groups encourage saving and, in some cases lend out the accumulated saving to different individual for various needs. To get a sense of farmers' spending, respondents were asked what their highest expenditure in 2016 was. Table 8.5 shows the items constituting farmers' highest expenditure in 2016.

The biggest expense for most of the respondents in 2016 was food, which means that increasing productivity and reducing food prices would be good for farmers whose highest expense is food. Other expenses include house construction, seeds and fertilizers, education, health, family functions, livestock and business. To meet the various financial needs, farmers have difference sources of income. For most respondents, the main source of income in 2016 was agriculture and casual labour.[225] Respondents also access money through saving and credit systems within SGs and SACCOs.

[225] See Table 6.1 in Chapter 6.

SGs are not new in Rwanda; about 5% of respondents already belonged to SGs before 2000 (Figure 8.1). SGs, normally called 'ibibina' (meaning club), attract various community members who save money towards a specific purpose. SGs operate in different ways. The most frequent structure is where group members gather regularly contributing an agreed upon amount of money. Depending on the arrangement, the full pot of money may be assigned to each member in turn or be deposited towards specific items (for example, members may decide to save towards a group cow, or buy a bicycle for each member). Members may decide to contribute more and take loans from the group. By saving small amounts of money these groups introduce community members to the culture of saving. About 47% of all respondents had savings in 2016 compared to only 4% who could afford to save before 2006. Table 8.6 sets out the main sources savings as described by respondents.

Table 8.6: Sources of savings for farmers

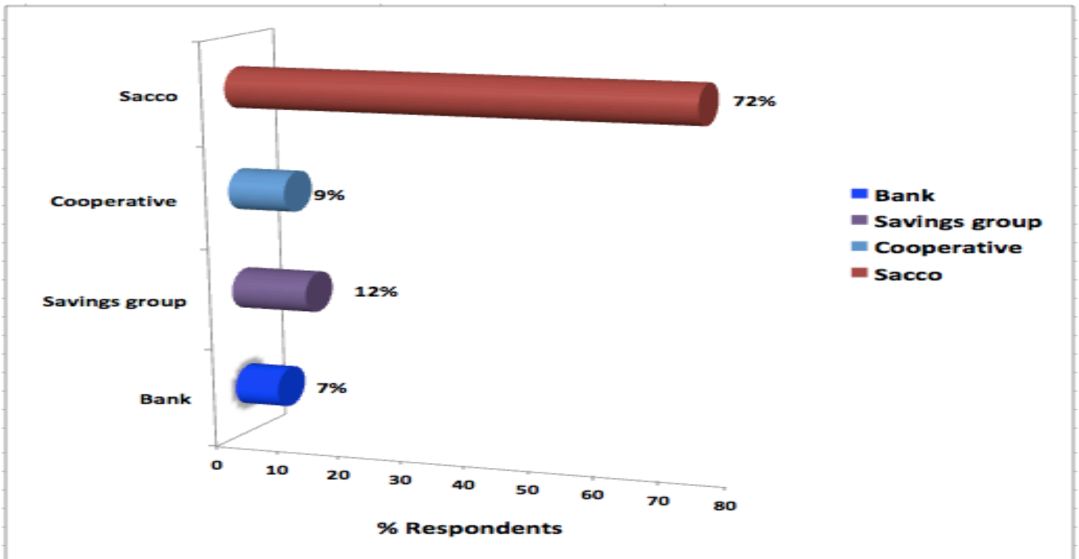
Sources of savings	**% Respondents**
Increased crop sales	35
Income from off farm job	15
Monthly salary	15
Livestock sales	15
Shares from cooperative	8
Incremental saving	7
Selling old compost	1
Land sales	4

Source: survey data

The highest percentages of respondents save when there is an increased income from crop sales. Other sources of savings include monthly salary, livestock sales, selling compost, and land sales. Some farmers use their incremental savings from cooperatives and SGs. For instance, farmers may receive money from an SG, which they then save in a SACCO. Compared to SGs, SACCOs are bigger, more formally structured and less interactive than SGs.

SACCOs are a new concept, introduced by the government in 2009 to build a saving culture and increase access to finance for rural communities. During initial stages of establishment, the SACCOs receive support from the government.[226] As with the cooperatives, to become SACCO members, community members enrol with a fee. Figure 8.2 shows that SACCOs are the main sources of credit for respondents. Other sources of credit are SGs, cooperatives and banks.

Figure 8.2: Sources of credit for respondents



Source: Survey data

Only 7% of respondents access credit from banks, perhaps because of issues such as accessibility and the stringent requirements often associated to formal banking institutions. The study shows that only 19% of respondents access credit through formal institutions (FinScope 2016).[227] Easier access to credit is one of the main reasons that farmers join SACCOs and SGs (Table 8.7).

---

[226] During initial stages of establishment, the government provides SACCOswith office space in public buildings, training and administrative costs. These privileges are removed once financial statements show that the SACCOs are economically viable.

[227] Finsocope studies show that access to credit increased in Rwanda from 9% in 2012 to 15% in 2016.

Table 8.7: Farmers' expectations from FAs and SACCOs

Organisation	Number of people
SG	
Save and access credit	96
Learn from each other	18
Friendship	6
SACCO	
Save and access credit	87
Access input credit	4

Note: Some members mentioned more than one reason for becoming SACCO or SG members.
Source: Survey data

Table 8.7 presents the main reasons for becoming SG and SACCO members. Majority of respondents became members of SGs and SACCOs to save and increase credit. In addition, some SGs members hoped to learn from each other and make new friendships. Those who become SACCO members anticipated the ability to access input financing.

As in farmers' organisations (FAs and FCs), Cross tabulation with Chi Square and a t-test analysis were used to gauge the impact of SGs and SACCOs on agriculture.

Table 8.8: Cross tabulation results showing the relationship between SG membership and various socioeconomic variables

Variables (% Respondents)		SG Member	Non SG member	Chi square (X^2)	t	Df	Sig
Gender (%)	M	38	36				
	F	46	48	0.139	-	1	0.401
Average age (years)		49	45	-	2.293	286	0.012*
Average Land size (ha)		0.44	0 .55	-	0.691	286	0.066*
Access to extension services (%)		64	57	1.257	-	1	0.159
Access to training (%)		26	16	4.663	-	1	0.021*
Access to improved seeds and fertilizers (%)		61	44	7.506	-	1	0.000**
Increased yield (%)		74	59	7.820	-	1	0.004***
Sold produce 2017 (%)		67	66	0.028	-	1	0.483
% with Savings		62	30	30.145	-		0.000***
Access to credit (%)		31	7	26.265	-	1	0.000***

***,**,* significant at 1%, 5% and 10% probability respectively

Note: No R^2 for age and land because Cross tabulation only done for categorical variables

Table 8.8 and 8.9 summarise the relationship between membership of SGs and SACCOs with different variables including gender, average age, average land size, access to training, extension service, inputs, increased yield, commercialisation, saving, and credit. The analysis maintains the same variables used in the assessment of FA and FCs (figure 8.3 and 8.4), for consistency and to enable comparisons between different groups.

Table 8.9: Cross tabulation results showing the relationship between SACCO membership and various socioeconomic variables

Variables (% Respondents)		SACCO Members	Non SACCO members	Chi square (X^2)	t	Df	Sig
Gender (%)	M	49	31				
	F	51	69	9.227	-	1	0.002**
Average Age (years)		45	48	-	2.108	386	0.05*
Average Land size (ha)		0.54	0 .47	-	-0.436	368	0.693
Access to extension services (%)		85	47	39.916	-	1	0.000***
Access to training (%)		30	16	7.178	-	1	0.006**
USE improved seeds and fertilizers (%)		73	41	27.640	-	1	0.000**
Increased yield (%)		77	61	7.669	-	1	0.004***
Sold produce 2017 (%)		78	60	9.712	-	1	0.001**
% with Savings		88	24	108.200	-		0.000***
Access to credit (%)		37	9	34.550	-	1	0.000***

***,**,* significant at 1%, 5% and 10% probability respectively

Note: No R^2 for age and land because Cross tabulation only done for categorical variables

As was found in cooperative, most variables were strongly linked to SACCO membership (Figure 8.8). This is not surprising, considering that more than 70% of respondents in FCs are also members of SACCOs. The relationship between the different variables are explained in the following paragraphs.

In close similarity to what was seen in farming organisations (FA and FC), SG and Sacco are gendered. Although not significant, SGs have more women than men and the reverse is true for SACCOs. The proportion of men in SACCO membership is considerably higher than that of women. As already explained in previous section, looking at cooperatives, the financial and time requirement in bigger and formal groups can be strenuous creating a barrier for women.

Interestingly, average age has a statistically significant associated with both SG and SACCO memberships. While SGs comprise of older members, those in Saccos are younger. This trend is also observed in farming organisations (table

8.3 and 8.4). Although not statically significant, the mean age of FA members was high than that of non-FA members and FC members. This is another indicator that small groups are more responsive to vulnerable groups including women and older farmers while bigger and formal groups attract younger farmers, mostly men.

SG and SACCO have a significant higher proportion of members with access to extension services, training, improved seeds and fertilizers compared to non-members. These groups also have higher proportions of members that have increased productivity and engage in commercialisation. The results underscore the strong link between access to finance and agricultural transformation. In most cases, cooperatives perform their cash transactions (farmers' payment for crops) through SACCOs, which prompts members open SACCO accounts. Cooperatives may also facilitate access to credit in SACCOs as a service to members.

As expected, the percentage of farmers saving and accessing credit is significantly higher among farmers in SGs and SACCOs compared to non-members. Paradoxically, 24% of respondents among SGs say they have no savings. This may be because of the way saving is managed; in some SGs savings/contributions are distributed at every meeting, so some members may not view this process as saving. Similarly, farmers may own a SACCO account but have no savings. However, the ultimate goal of embedding SGs and SACCOs in local communities, where they are accessible to community members, is to encourage saving. While SGs are often within the community where members live, the average time to a SACCO office for SACCO members and non-members is an hour.

Despite the benefits of being in a group, about 27% of the respondents were not in any. Table 8.10 summarises some of the reasons given for not joining any group.

Table 8.10: Reasons why Respondents were not in any group

Reasons	% Respondents
Limited finances	54
Organisation not necessary	25
Lack of information	11
Long distance to travel	3
Too old to join a group	3
Organisation not available in my village	2
Issues of accountability in one I had joined before discouraged me	2

Source: Survey Data

The majority (54%) of the respondents who did not join any farmers' or financial organisations say that the biggest constraint is lack of finances. Other barriers to group membership include lack of information, distance to the group, unavailability of the group, old age and previous experiences. Some (25%) respondents did not think joining a group was necessary.

This section shows that most farmers are in grassroots organisations and that being a member of these organisations increases the prospects of accessing services and inputs that are beneficial to agriculture. By encouraging people to become member of Cooperatives and SACCOs, the government aims to improve inclusion; promote collective action and enable access to information, knowledge, technology, finance, market and reduce transaction cost for rural smallholder farmers.[228] While we see a huge rise in membership in all groups since 2000, more farmers were found to be members of financial institutions. This may signify a quest among rural farmers for financial inclusion.

A Cross tabulation analysis shows that Cooperatives and SACCO were found more effective in providing a range of services to most of the members including

[228] These policies are discussed in detail in chapter 2.

access to advisory services, training, inputs, finance and markets, making them important drivers of economic advancement. On the other hand, results show that although farmers associations facilitate increased yield through technical change, less members engage in crop sales.

As expected SACCOs and saving groups were found strongly linked to access to finance. Members of these organisations were found more likely to save and access credit. Similar to cooperatives, SACCO membership is strongly associated with agricultural commercialisation. Pesha et. al (2017) also show that grassroots financial institutions can enable business management among farmers and facilitating increased productivity.

Despite the significant role of the formal state supported Cooperatives and SACCOs in advancing agricultural productivity and commercialisation, these groups were found likely to appeal to more resourced (members have above average landholdings), young and male farmers. Self-supported farmers' associations and saving groups comprise more of the difficult group of people to reach such as women, elderly and poorer farmers.

8.2 Factors that affect farmers' participation in produce markets

Commercialisation is the main route farmers use to generate income from agriculture, making it an important feature of agricultural transformation. One of the key goals of the recent agricultural reforms is to enable greater commercialisation among farmers to increase rural income. This section presents farmers experiences in agricultural commercialisation since the reforms, and analyses factors that affect farmers' participation into markets.

In contrast to the situation before 2000, today, farmers associate a good harvest with money. In a survey carried out in western Rwanda in 1985/86, farmers were asked why they grow the crops they do (Von Braun, De Haen, and Blanken 1991). With the exception of farmers who grew potatoes for cash and food, the top response for all food producers was, 'we want to consume it. That is why we grow it'. While tea and coffee were emphasised for commercialisation at the time, food production was mostly subsistence.[229] A district agronomist explained how the predominant subsistence food production systems were a disincentive for technology adoption:

> The truth is that, long ago [meaning before 2000] food production was not as marketable as it is today. It was therefore difficult to tell a farmer to produce more beans and maize for the market when crops were mostly grown for home consumption.[230]

With less developed food markets, it is not easy to motivate increased productivity through innovation. Around half of the respondents (51%) say they have experienced significant changes in produce trading. In their responses, some respondents say that they have observed increases in produce crop prices. This is in line with the 2010 World Bank trading report that shows that farmers in Rwanda received higher maize prices between 2006 and 2010 compared to 2000 and 2005. [231] This, together with farmers' experiences, seems to indicate that produce prices paid to the farmer for various crops have generally gone up. A farmer in Nyanza explained why she was receiving better prices: A farmer in Nyanza explained why she was receiving better prices:

> Years ago [2000 and before], our harvest was limited. For example, I would only manage to occasionally take a small amount of produce, like 1-5kgs, to the market and get whatever price the buyers offered. Now, with increased yield I am able to take more to the market in bags of 100kgs and negotiate better prices.[232]

---

[229] Chapter 2, Section 1 discusses Rwanda's policies before 2000.
[230] Interview DAM.
[231] Prices received by farmers for primary goods were considerably higher after 2005 as reported by the World Bank (2010) <https://tradingeconomics.com/rwanda/producer-price-for-maize-per-tonne-current-us$-wb-data.html>.
[232] Interview with FM6.

Farmers' experiences show that a rise in crop volume has attracted better markets and increased their negotiating power. However, higher investment in agriculture to increase productivity also makes farmers more vulnerable to food price fluctuations. Farmers highlighted that crop prices are especially low during harvesting when there is plenty of produce. While this is beneficial for net food purchasers, low food prices can be a disincentive for farmers. In some cases, the government sets a minimum price for specific crops (those most vulnerable to price fluctuations, e.g rice and maize) to protect farmers from significant losses. For instance, an article in Rwanda Today showed that the price of a kilo of maize was set at a minimum price of 200 Rwf (20 pence) in April 2019.[233] Starting from the set price, farmers and traders negotiate higher prices.

Figure 8.3: Photo of a potato collection point in Musanze district

Source: Author's own

In some cases, local leaders are involved in linking farmers to markets, and they may point traders to consolidated areas or cooperatives where farmers are likely to have bulk produce. Farmers highlight local leaders' involvement into agricultural marketing as a recent change. This is important considering the issue of information asymmetry in rural areas. Figure 8.3 shows a potato

[233] Rwanda today April 28 2019: < http://rwandatoday.africa/business/Hoarding-to-raise-flour-prices/4383192-5091850-ryxloa/index.html>.

collection centre in Musanze district, where farmers bring produce to sell in bulk.

Both policy makers and farmers mentioned the increase of communal storage as an important achievement. Although storage space in Rwanda is still limited compared to farmers' output, there has been a steady increase over the last decade.[234] About 13% of respondents used communal storage for keeping produce in 2016, compared to 2% around 2005. In some cases, communal storage facilities also have drying areas. In areas where production has increased, it was evident that farmers have bigger drying areas at home. Figure 8.4, a picture taken in Gatsibo, shows the type of temporary drying facility farmers build for maize harvest.

Figure 8.4: Photo of household drying ground in Gatsibo District

Source: Author's Own

With the limited amount of harvest in the past, postharvest infrastructure was not a concern. Some respondents revealed that storages were often empty:

[234] See Chapter 2, Section 3.

> Before [meaning before 2000], our harvest was small and so there was little that went to the market, this storage would sometimes be empty. But now I take about 1 ton to the market every season. So I sometimes need this storage. What really changed is that we increased yield.[235]

As a senior government figure revealed, the issue of postharvest losses became more apparent as crop intensification progressed and production increased:

> By 2010, the key problems for Rwanda and Rwandan farmers included produce markets and postharvest losses. (…..). Looking at how rain was impacting on the quality of produce, we introduced postharvest infrastructure at village level. Most of that was with support from the government (…). We also encouraged the development of storage facilities by the private sector. (…) Government stores would be stocked through buying at last resort. In this model, the private sector buys produce from farmers first and if some farmers failed to get buyers, the government steps in to buy it (mainly maize and beans). The produce would then be used as national strategic reserves or resold to the public when it was clear that it was no longer needed.[236]

The rise in productivity driven by CIP created the need for innovative ways to increase postharvest capacity and link farmers to markets. In response, both the government and the private sector invested in storage infrastructure and in buying grain to enable greater commercialisation among farmers.[237]

About 67% of respondents participated in produce markets in 2016 using various channels. Figure 8.5 shows that in 2016, 50% of the respondents sold crop produce to traders. Other market channels were village markets,[238]

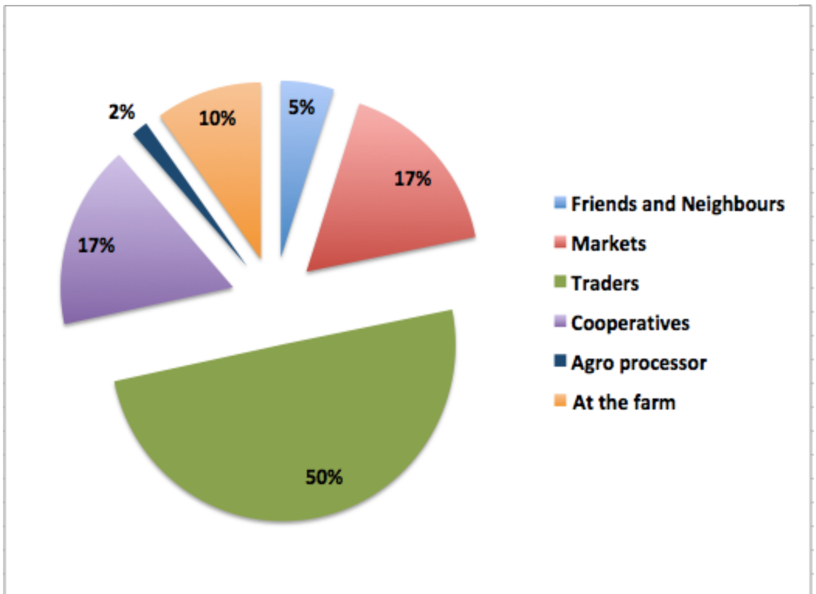
---

[235] Interview with FM19.
[236] Interview with MAK.
[237] Chapter 2 Section 4 discusses

[238]A market in this case is a structure where farmers display produce for sale.

cooperatives, and agro processors. Some respondents sold produce directly from the farm and others to friends and neighbours

Figure 8.5: Market channels for crop sales



Source: Survey data

The fact that more farmers sell produce directly to buyers signifies a shift from traditional forms of agricultural commercialisation. Village markets are the traditional places where farmers sell and buy food and other items. Yet only 17% of respondents who sold produce in 2016 traded through village markets. Village markets are more predictable in terms of when and where they happen.

Typically, the level of participation and the market channels used depend on the type of crop and quantities available for trade. Farmers with larger quantities of produce are likely to attract bigger buyers. In Gatsibo district, a farmer noted that crop buyers are diverse and more frequent:

> Now we have more buyers. Buyers come to us looking for produce even if it is not a market day. [239]

The next section analyses the factors that influence farmers' participation in produce markets.

8.2.1 Factors Affecting Farmers Engagement In Produce Markets

In addition to testimonies from respondents, factors influencing farmers' participation in produce markets are analysed statistically using Logistic regression.

Logistic regression is used to determine the relationship between commercialisation, which in this case means crops sales and other social economic and institutional variables. The commercial farmers analysed in this section comprise of only 56% of the respondents who engaged in produce trade in 2016 and five years prior. The dependant variable is dichotomous with 1 representing commercialisation and 0 no commercialisation. The independent variables included in the analysis were drawn from the literature[240] and previous chapters, based on their significance in increasing farm output.[241]

The independent variables included are: age, gender, distance to trading centre, distance to a village market, average land size, access to improved seeds and fertilizers, productivity and membership to farmers organisation (Farmers associations, cooperative and SACCO) ownership of a phone. The expected relation between the dependant and independent variables is elaborated in the methodology chapter 4.

---

[239] Interview with FM 246.

[240] See the section on commercialisation in Chapter 3 section 3

[241] The literature reviewed in Chapter 3, highlights key factors affecting farmers' access to markets; Chapter 7, Section 3 highlights factors related to increasing yield.

The **Age** of the respondent could have a positive or negative effect on participation in produce market. Age is a proxy measure of experience and availability of resources (Martey 2013). It is also possible that decisions to participate in the market depend on older members of the household. In this case the age of a farmer would be positively related to participation in produce markets. Alternatively, as seen in this research and other studies, younger farmers may be more capable with regards to adoption of innovations both in terms of those that would enhance their productivity and generate a marketable surplus (Enete and Igbokwe 2009).

The **Gender** variable captures the differences in market participation between males and females with males expected to have a higher tendency to participate in markets than females. There are suggestions that men are more business oriented than women (Cunningham 2008). Some have highlighted the fact that men's affiliation to produce marketing is linked to their need to control household income (Leavy and Poulton 2006). However, there are a number of barriers including poverty, limited access to land, and other resources that could limit participation in agricultural markets (Dorward, Marrison, and Urey 2004).

Households who have easy access **markets and trading centres** are more likely to participate in markets. Long distances to market areas may act as a barrier by imposing transaction costs.

Since the **size of landholding** is directly linked with the level of production surplus generated, it affects farmers' ability to engage in 3commercialisation (Olwande 2010). As already shown in this thesis, 393 the size of land owned determines whether a farmer increases production beyond subsistence farming. With increasing land scarcity, intensification policies aim to increase productivity and enable commercialisation.

It is posited that increased contact with **extension services and adoption of new** technologies results in increased productivity and greater commercialisation. Access to extension services and the use of improved seeds and fertilizers were found significantly related to higher levels of productivity.[242] Through extension agents' farmers acquire the information and knowledge needed to adopt the techniques that increase crop yield. In Rwanda, extension services, improved seeds and chemical fertilisers were made available to rural farmers to support increasing productivity. However, as already highlighted, **increasing productivity** does not always lead to a marketable surplus.

It is anticipated that membership to **farming organisations** has benefits like access to new technologies, extension services and markets. In addition, collective marketing through farmers' organisation leads to better bargaining power and lower transaction cost for farmers (Bernard et al. 2008). Financial cooperatives like **SACCOs** enable members to successfully engage in agricultural business. The logistic regression therefore includes membership to **Farmers' Associations, Cooperatives; SACCOs** as the main grassroots organisation found relevant to agricultural marketing.[243]

Increasing use of **mobile phone** is changing the way farmers do business. By improving communication, mobile phones are seen to be reducing transaction costs for farmers (Mittal 2016). Market information is transferred quickly from farmer to farmer making it easier to make decisions about crop sales. Ownership of mobile phone was therefore included in the logistic regression as one of the relevant variables for commercialisation. Table 8.11 shows the results of the cross- tabulation analysis.

---

[242] Chapter 6 Section 4 and chapter 7 section 3 analyse factors that influence technology adoption and increased productivity respectively

[243] See previous section 8.1

Table 8.11: Results of a logistic regression showing factors that affect farmers' participation in markets

Independent variable	B	S.E.	WALD	Sig.	DF	Exp(B)
Average age	0.028	0.011	6.762	0.009**	1	1.028
Gender	-0.490	0.322	2.318	0.128	1	0.613
Distance to the market	0.009	0.003	7.293	0.007**	1	1.009
Distance to the trading centre	-0.004	0.013	0.080	0.777	1	0.996
Average land size (ha)	1.364	0.586	5.424	0.020*	1	3.913
Access to extension services	0.153	0.353	0.187	0.665	1	1.165
Use of improved seeds and fertilizers	0.578	0.341	2.863	0.091*	1	1.782
Increased yield	0.336	0.332	1.025	0.311	1	1.399
Membership to a farmers' organisation	-1.131	0.508	4.955	0.026*	1	0.323
Membership of a cooperative	2.050	0.654	9.818	0.002**	1	7.771
Membership to a SACCO	0.264	0.341	0.617	0.432	1	1.307
Phone	0.376	0.323	3.798	0.242	1	1.457
Constant	-1.671	0.857	3.798	0.051	1	0.188

Results indicate a significant correlation between participation in produce markets and age, distance to markets, land size, use of improved seeds and fertilizers, and membership of cooperatives, as well as to membership to farmers' associations. Gender, distance to trading centre, access to extension services, increased productivity, and membership to a Sacco, were not found to be statistically relevant to agricultural commercialisation. These results are further explained to understand the impact of each variable on farmers' decision to participate in produce market.

Similar to the findings of Martey (2013), **age** was found to be positive and closely related to crop sales. This is contrary to previous chapters, which show that younger farmers are more enthusiastic with regards to technology adaptation and were more likely to increase productivity.[244] When it comes to commercialisation, the average age of the respondent had a positive and significant correlation. This means that older farmers were more likely to participate in produce markets. This may be because the majority (70%) of respondents lie between the age of 40 and 60 years, which is the category of farmers who own larger pieces of land (see Table 7.2 page 244). Although most respondents are smallholders, farmers with larger and more pieces of land are able to expand production and generate a marketable surplus. However, as farmers get older their resources reduce.

Gender was not found to be statistically significant to commercialisation, but it had a negative relationship, meaning that men are more likely to engage in markets than women. This is consistent with the earlier findings (section 8.1), which reveal that there are more men than women in market-oriented organisation like cooperatives.[245] Interestingly, the logistic regression results in Tables 6.7 and 7.7 show that women are more likely to adapt new technologies and increase productivity compared to men. Further investigation may be needed in order to understand why women who are more likely to adapt to new technologies and increase yield are less likely to engage in produce markets. It may be that, although Rwanda is leading in advocacy and promotion of women in economic activities, socioeconomic and cultural barriers to participation still exist. Women farmers may be constrained by land.

Distance to the market was found positive and closely related to commercialisation. This is contrary to the expectation that easy access to markets would encourage participation in markets. The average time to the market for all respondents was 1 hour 15 minutes but distances ranged from 5 minutes to 4 hours. The study finds that some farmers in Gatsibo who live 4 hours away from a local market were able to market produce through the

---

[244] Chapter 6 Section 4 and chapter 7 section 3 analyse factors that influence technology adoption and increased productivity respectively.

245 See table 8.4 of this chapter showing the relationship between FC membership and different socioeconomic factors and institutional variables.

cooperative. The negative relationship shows that the closer farmers are to a trading centre the more likely they are to engage in produce marketing. Trading centres often become collection centres for produce and places where farmers interact with buyers.

Mobile phone ownership had a positive relationship, which was not found statistically significant to commercialisation. About 40% of the respondents owned a mobile phone. With a telephone, farmers are more connected to each other and to the world beyond their village. This connection creates linkages that could potentially introduce farmers to new markets. Market information is quickly transferred from person to person allowing farmers to make choices. As mentioned already, farmers access information from several sources including local leaders and extension agents.

Contrary to projections, **access to extension services** is not significantly linked to crop sales. Yet previous chapters highlight access to extension services as one of the most significant factors affecting use of improved seeds and fertilizer and productivity. The positive natures of the relationship show that access to extension services leads to greater participation in produce markets. Adaptation of improved seed and fertilizers was found strongly linked to commercialisation. Sustainable intensification through the use of capital-intensive technologies has to be linked higher yields and greater crop sales to incentivise purchase of inputs.

As expected, **membership of a cooperative** was found to be significantly related to commercialisation. On the contrary, membership of farmers' associations was statistically significant with a negative B coefficient. This is consistent with findings in Section 8.1, which show that cooperatives are more linked to commercialisation, while fewer members of farmers' associations participated in produce markets. Whereas a large proportion of members of farmers' associations adapted new technologies and increased yield, output and participation in produce market seems to be constrained by land size.

These small associations are mostly composed of women and poorer farmers who own small pieces of land.

Membership of SACCOs was not found to be statistically significant to commercialisation but it had positive B coefficients. Members of the SACCO were found to be more likely to engage in commercial activities. This result is in line with the earlier finding in section 8.1 that shows that financial inclusion fosters greater agricultural commercialisation.

It is not surprising that **landholdings** were found to be positive and significantly related to the likelihood of participating in produce markets. This suggests that farmers with relatively bigger land were likely to engage in produce markets. Although results in Chapter 6 show that the prospects of improving yield increased with landholding, the size of land seems to limit market participation. In most cases, farmers with small holdings are not able to produce a surplus for the market. The impact of intensification on commercialisation is, therefore, strongly linked to access to land. Landless farmers and those with very small plots of land may turn to alternative non-farm sources of income.

Table 8.12 lists a number of alternative sources of income for non-commercial farmers in 2016. Most of these respondents turn to casual labour. Other sources of income include, sale of livestock and livestock products, off-farm activities mainly small businesses, salaried jobs, money gifts from friends and family, and social services from the government. Those receiving support from Vision 2020 Umurenge Program (VUP) are in the category of the very poor. VUP is a social protection program that supports poor and vulnerable people. The government may offer work or financial support. For instance, people with 0.25ha of land and who are unable to work are eligible for direct financial support from the government (GoR 2011). Only 5% of respondents received VUP support in 2016. This is may be an indication of the limited coverage of the VUP program to all the individuals who need this kind of support.

Table 8.12: Alternative sources of income for non-commercial farmers

Sources of income	% Respondents
Casual labour	51
Sale of livestock and livestock products	20
Off farm activities (business)	10
Monthly salary	5
Government Social Support	5
Friends and family	5
No income	4

Source: Survey data

This section shows that the bulk of farmers (more than 50%) participate in crop sales. When comparing to the period before 2000, farmers say that crop yield and prices are higher, and they access better markets.

Results from a logistic analysis show that participation in produce markets is influenced by, age, land size, use of improved seeds and fertilizers, and membership to cooperatives. The strong correlation between adaptations of improved seeds and fertilizers with commercialisation suggest that the Crop intensification policy has had a positive impact on farmers' income. However, the extent to which intensification leads to increased commercialisation is subject to the size of landholding. As expected, farmers with tiny pieces of land were found less likely to engage in crop sales.

Non-commercial farmers, particularly those with limited land, were found to turn to casual labour as an alternative source of income. Only a few (5%) of non-commercial respondents receive government support through VUP. More coverage and better targeting by the VUP program could reduce vulnerability for farmers with limited land and alternative sources of income. In situations where the agricultural policy has limited potential to aid the required transition out of poverty, more comprehensive strategies are needed to provide alternative livelihoods for farmers (Dorward et al. 2006). This shift is complex and requires collective effort at grassroots and national level. The next section traces and analyses collective action at the national level between the state, donors and the private sector that have supported agricultural change at the grassroots.

8.3 The state, donors and the private sector and their interactions to support farmers

There are several key players within the agricultural sector. Previous sections of this chapter have shown that interactions between different actors, including farmers, extension agents, local leaders and markets, have supported agricultural productivity at the grassroots. Whilst it is understood that development is a collective problem, sometimes partners have real trouble imagining what to do differently to create the required changes (Booth 2012). This section will identify the different forms of collective action at the national level and assess the impact of agriculture. It will look at the interaction between the state, donor and private sector and how these relationships have evolved to respond to different key challenges in agriculture.

8.3.1 The State takes the lead: New forms of engagement between government and donors

MINAGRI has relies greatly on foreign assistance to generate the funds needed to provide the required services and infrastructure for farmers. The media has sometimes labelled Rwanda as the darling of donors.[246]

---

[246] TRT world (2019) Burundi is no Aid orphan and Rwanda is Aid darling https://www.trtworld.com/opinion/burundi-is-no-aid-orphan-nor-is-rwanda-an-aid-darling-27916

This section focuses on agriculture to offer insight on ways in which the government navigates relationships with international donors.

The main international donors in the agricultural sector during the formulation of PSTA1 in 2003 were the World Bank (WB), African Development Bank (ADB), International Fund for Agriculture Development (IFAD), Department for International Development (DIFID), USAID, European Union (EU), Food and Agriculture Organisation (FAO), the Netherlands, Belgium, China, and NGOs. The donors evolved in the sectors before the reforms become an integral part of the agriculture development process. However, there was a notable shift in stance towards donors. A senior and long serving MINAGRI official highlighted the dominant views on agriculture among MINAGRI staff before the reforms:

> Before 2000 agriculture was subsistence in nature and policies were such that it remained so. The Ministry of Agriculture consisted of people who had worked in agriculture for a long time and become comfortable with the status quo. You would often hear people say 'Rwanda is small and unproductive and nothing much can be done about that. We will always be dependent on donors.' This was the general thinking. [247]

This resonates with the narrative in chapter 5, which alludes to the deliberations on the prioritisation of smallholder agriculture for economic development. The question of dependency is real, as aid can become a barrier to the recipient countries' development (Moyo, 2009). Given Rwanda's history and the genocide, the country has been reliant on foreign aid and agendas. According to a government senior advisor, international donors drove the development policy after the genocide:

> I tell you, in 1994, 1995, 1995 and 1996, I think the UN was driving everything in this country. From writing projects and implementing

[247] Interview with MIM.

> them. Then after the Urugwiro, 1999-2000 [formulation of Vision 2020], one of the governance decisions was that the government must be in the driving seat. And so we started negotiating with donors and private sector about investing around our [government] concept.[248]

The 1999-2000 Urungwiro meeting was pivotal moment in Rwanda's development history. Through a consultative process, policy makers crafted new reforms that fit Rwanda's context to address the prevalent challenges. This shift to government–led development processes presented new opportunities and challenges and changed the nature of relationship between the state and donors. Knowing that in order to achieve the government goal, the volume of aid would have to increase, both parties had to find common ground. Firstly, there was a need to strengthen the country's financial systems, in order to build donor confidence. As told by a senior government official, it was recognised that the set goals would be met collectively.

> The important thing really is, knowing where you want to go as a country and how you want to get there. Then getting the actors on board. [.....]. We started negotiating with donors to invest around our concept. There was effort in building country delivery systems to improve efficiency and win donors' trust and attract investment.[249]

In 1998 the office of the auditor general was created. In the same year the Central Projects External Bureau, a semi-autonomous body under the Ministry of Finance, was created to facilitate the shift from emergency to project financing. By 2000 the country had rebuilt the Public Financial Management (PFM) to facilitate planning and budget management (GoR 2006a), and aid was gradually being delivered under government leadership. A government official revealed that the new policies and institutions gave the government confidence to take the lead:

---

248 Interview with MM.
249 Interview with MM.

If there is a problem, it is up to us to solve it. In solving it, it does not mean that we do not want people to assist, but they should assist us in the way we need to be assisted. […] Previously, before 2003, we would receive several international experts coming to tell us where to go and how to get there. […][250]

Collective action with countries taking the primary responsibility of the development agenda was in line with the 2005 Paris declaration. Subsequently, Rwanda formulated a new Aid policy in 2006 iterating that Aid not aligned to government policy or with excessive conditions would be rejected (GoR 2006b). There was preference for budget and sector support over projects to give government more control of planning and budgeting. Donors who preferred projects were requested to align funding to the national budget and plan. Contrary to previous practices, the new requirement meant that funds from key international donors would be closely monitored through government ministries, mostly to ensure efficient use and alignment with national goals. As already highlighted in chapter 5, the government recognised the lack of in country capacity to implement government policy and donor projects.

Generally, there was limited in-country capacity to execute the different donor projects. For example, in the World Bank funded RSSP [251]the capacity of local companies to build irrigation dams was non-existent; very few local engineers had the required knowledge to supervise construction works.[252] Determined to succeed, the government reinforced implementation teams and worked with the WB to outsource capacity. International companies were hired to form joint ventures with local companies and national staffs were trained. Due to capacity challenges, the first phase of the project ran for eight years instead

[250] Ibid.
[251] The World Bank RSSP1 project is mentioned in chapter 2
[252] World Bank 2012 RSSP 3 project appraisal document

of five. Taking lessons from this experience, the project team completed the second phase one year before the expected completion date, making up for some the time lost in the initial phase. [253]

The national Imigo (performance contracts) requiring targeting each year was important for planning and ensured that public servants follow through on targets and policy promises. The annual performance contracts system and annual financial audits from the Auditor General keep public servants, including ministers, on their toes. In addition, CEPEX (now closed) monitored donor projects closely to provide support to struggling projects and to prevent significant execution delays in different ministries (GoR 2000). As a result, implementation capacity and budget execution within ministries improved dramatically. For example, budget execution improved from 46% in 2009 to 85% in 2013. This has been significant in attracting funds from donors to finance the agricultural strategy.

The public expenditure review of 2014 revealed that between 2009 and 2013 over 50% of MINAGRI's budget was financed through donor support (MINAGRI 2014). The review shows that donor financing in agriculture more than doubled between 2009 and 2013. The increase can be attributed to the changing government and donor relationship, where both parties agreed on investment areas, roles and responsibilities, and sources of funding. The relationship was reinforced by the CAADP process, which underscores cooperation between key partners to mobilise resource agricultural transformation. In my view, the government and the donors aimed to keep each other accountable on development issues:

> The donors were sometimes uncertain about new government policies. For instance, the main questions concerning the CIP policy were: 'how will the government finance bulk fertilizer import and distribution to rural areas? Is land consolidation going to be good for smallholder

[253] World Bank 2008 RSSP 2 Project appraisal document

> farmers? The sector working groups was an ideal place for intense policy deliberations.[254]

The Sector Working Groups (SWG) started after MINAGRI and donors signed a sector-wide approach Memorandum of Understanding with its partners in 2008 (MINAGRI 2008). The aim of the SWG was to improve communication and coordination among key stakeholders:

> We started participating in the agriculture sector-working group, which is like a policy group that brings together donor institutions chaired by the minister and the permanent secretary. Donors and private sector participate; also NGOs and anyone interested in agriculture development in the country. Sometimes people from other ministries also come, Ministry of Trade and Health. In that forum ministries get input from pretty diverse stakeholders.[255]

Both the stakeholders and MINAGRI hold each other accountable on implementation matters. Through this forum stakeholders contribute to policies and laws that affect agricultural performance. As a donor representative commented, donors were willing to support governments efforts to improve development performance:

> We sit and plan policies together. Our role is to think of what contribution we as development counterparts can make. Since policies are matured at government level, our role is to accompany the government as much as we can.[256]

Another partner attributed the agricultural performance to strong leadership:

---

254 Own experience.
255 Interview with ADT.
256 Interview with DFO.

> You have an incredible leader in the Ministry of Agriculture (..), who just pushed everyone to do better, brought the institutions together, who challenged them, called out the performer, called out top performers each year. I don't think that change happens by the nature of the ecosystem. Change is as a result of the leadership. [257]

MINAGRI leadership was key in motivating different stakeholders, including ministry staff. With everyone focused on performance, the unequal power relations that often affect relationships between the donor and recipients was minimal in MINAGRI. A coordinator for a donor project described the shift to a balanced relationship between the donor and project team:

> It is no longer them [donors] designing projects and bringing them to us to implement. It is teamwork. They [donors' representatives] come and we sit together and we tell them look this is what we want to achieve, these are the activities that will help us achieve our national goals. At the end the project documents that are prepared and designed come as a collective effort and this has been successful. [258]

The notion of collective and partnership offers a vision of aid relations on a more equal footing. Yet these relationships are fundamentally complex. On one hand donors may impose multiple, difficult and uncoordinated conditions and often present one size fits all solutions and on the other we have receipts that may lack the capacity, organisation and commitment to implement donor projects (Kayizzi-Mugerwa 1998). This section shows that Rwanda's own process of strengthening relationships with donors is commanded by: the country's ability to curved out its own development approach; developed innovative and inclusive institutions; enhanced implementation capacity; developed tools for monitoring performance; aims to improve governance and implement a no corruption policy. Subsequently, this structure provides

---

[257] Interview with ADT.
[258] Interview with PSE.

potential flexibility in facilitating Rwanda's relationships with donors. This is not a given, it is a result of the government openness and wiliness to create policies and institutions that allow joint planning and accountability. As argued by Whitfield Lindsay (2010) countries like Rwanda benefit from the ability to design coherent development strategies that increase government ability to defend their policies in aid negotiations. Similar approaches are used to attract the private sector into the agricultural development process. The next chapter describes the development of a private led input distribution system.

8.3.2 The shifting roles of the State and Private sector in fertilizer distribution

This section explains the process of building a national fertilizer distribution system from scratch. Prior to 2006, fertilizer was entirely imported by private companies, including those who supplied coffee and tea farmers. In most cases companies bought small lots of fertilizer from neighbouring countries against a confirmed order, (GoR 2007). By 2008, MINAGRI had become the sole importer of fertilizers, a role it handed back to the private sector five years later. [259] This section uses the agrodealer[260] lens to analyse the relationship of the government and private sector in building a national input distrib ution system that makes fertilizers available for farmers in all locations.

In the early stages of CIP, MINAGRI invited private companies in the agriculture sector for partnership in the fertilizer distribution business. Building on existing networks and experience these traders became important conduits through which MINAGRI distributed fertilizers to rural areas. Among those who showed interest were agro dealers who say they had prior experience in fertilizer distribution but on a small scale,

---

[259] The fertilizer distribution system and policy is discussed in Chapter 2, Section 4.
[260] An agrodealer is an individual, cooperative, or business organization that engages in the sale and purchase of agricultural inputs.

> The company I worked for used to sell fertilizers to farmers. We engaged in input trade around the time CIP was introduced [2007].[261]

> In 2006, I started trading in inputs because I saw there was demand in my village. I had a shop that sold pesticides for tomatoes and cabbage. Farmers didn't really know about chemical fertilizers then.[262]

Drawing from the different discussions with agrodealers the process of developing a private sector led input distribution system can be described in 3-stage:

Stage 1: **Piloting -** During this stage, the government begun to export fertilizers, which was distributed through CIP to food producers in a few location. Agrodealers described how they coordinated fertilizer distribution with government during piloting stage:

> So, from like 2008, 2009, 2010, we had the government importing fertilizers and then tendering it out to district distributors [agrodealers]. (…). Fertilizer was delivered by private companies but under a contract with the government. So it was fairly prescriptive, [for example] I would take 5 tonnes of fertilizers from MINAGRI to farmers in a specific district sector. In the same sector extension services were contracted. [263]

> The Ministry of Agriculture had an agreement with us [CompanyX] to distribute fertilizers to specific parts of the country. The arrangement was that we use public storages as distribution points. The government also gave fertilizers to us on credit and we looked for customers for fertilizers.[264]

---

[261] Interview with ASA.
[262] Interview with ADN.
[263] Interview with ADT.
[264] Interview with ASA.

> Once the distributors had delivered fertilizers to the district, each sector signed for the quantities received and we were in charge of selling it to farmers. Farmers came to us for fertilizers, they paid us and we deposited the money on the designated MINAGRI account. Farmers who could not afford to pay cash received fertilizers on credit, but some did not pay back. You know the government has had problems with fertilizer payment up to today.[265]

Figure 8.6: Farmers buying chemical fertilizer at a storage facility

Source: Author's own

The purpose of this stage was to create a private sector led fertilizer supply chain, generate demand at the grassroots, and identify potential problems with the CIP approach. Since it was anticipated that the cost of fertilizers was bound to become a barrier, agrodealers were allowed to provide credit to farmers with limited financial capacity. This led to fertilizer repayment issues that exist to date. The fertilizer distribution process was closely monitored by MINAGRI staff and hired service providers who also offered training and

[265]Interview with ADN.

advisory services to farmers. In some cases, particularly for maize, seed was given as a package to fertilizer users at no cost.

Stage 2: Government led systems - The second stage aimed to scale up input distribution to all districts. As such, MINAGRI invited more companies to participate in fertilizer distribution auctions. At this point the government introduced a crop-based fertilizer subsidy accessed through a voucher system. Although the government was the sole importer of fertilizers, as more private traders participated, fertilizer distribution became more competitive:

> We had more private companies involved at this stage. This is when you start to see an auction process for bids. All the distributors were brought to a public auction for distribution rights in different districts. The process was getting more competitive.[266]

> Following the introduction of the subsidised fertilizers it was difficult for fertilizers from our company to compete. This was because a Kilogram of fertilizer from our company cost about 600Rwf while NPK from the government cost 400Rwf.[267]

> In 2010, when the national agrodealer started in Nyanza I was invited for training as a person already involved in agricultural inputs [shop owner]. The IFDC project trained us and took us for study tours in Tanzania where we visited fertilizer factories. We learnt about the chemical composition fertilizers and how to manage fertilizer stock. I then started working with MINAGRI as a distributor.[268]

At this stage we see a crowding out of the private sector from importing and independent trading but an increase in Public Private Partnership (PPP). The

---

[266] Interview with ADT.
[267] Interview ASA.
[268] Interview ADN.

CIP program expanded to all district; a fertilizer subsidy was introduced, new distribution networks that included new private companies were created; and capacity building programs for agrodealers were initiated. Through auctioning distributors who won bids were expected to make a down payment of 30% and pay the balance to the government after receiving payment from farmers (IFDC 2014). This was to facilitate credit at the district level. Using a voucher system, farmers accessed cheaper fertilizers from agrodealer near them. However, the fertilizer distribution process had a number of challenges.

The primary issue was that fertilizer importation was a strain on the national budget. Moreover, credit arrears from defaulters were accumulating. Also, the high risks of fertilizer smuggling to neighbouring countries presented additional cost of follow-up and monitoring of the input delivery process (MINAGRI 2015). To minimize cost, a more private sector-engagement was pursued.

Stage 3: **Private led systems** – After 5 years, the government withdrew from importation, giving the private state the role of fertilizer import and distribution. Some agrodealers say that by taking on the risk during the initial stages of CIP, the government was able to develop the fertilizer markets rapidly. Having participated in distribution from the beginning and seen the potential of developing a vibrant fertilizer distribution business the private sector was ready to take over:

> In 2014, the government had sufficient trust and confidence in the private sector. (…) The private sector had 5 years of practice, where the government took on most of the risk. The government brought fertilizer and the private sector delivered it. We got fertilizer on loan from the government and then we paid the government back. So the government took on all the risk and that helped to develop the market (…). And

> without government taking on the risk, the process would have been a lot slower. [269]

> Our interest in agriculture increased when we realised that there was huge potential in the farming sector. For example, since 2013, the government is no longer involved in fertilizer imports. I am one of those who import fertilizers and things are going well because farmers are buying.[270]

Fertilizer importation and distribution was handed over to the private sector. Agrodealers comment on the pressure of being in charge of fertilizer distribution:

> As importation rights transitioned from one side to the other, we felt accountable. We know if we do not deliver, we are failing the country and farmers who are our direct clients. There is a good amount of pressure to import inputs on time. (…) Also if we deliver late we do not sell. If we deliver late farmers do not plant on time and they do not use the inputs. Then we are stuck with actual inventory, so I think the private sector gets it in a more real way. [271]

> The government sends out messages for meetings if they need us. Apart from that, we mainly have our business in rural areas and without interference. However, government monitors our work and performance. They regulate quality of inputs being distributed. In addition, there is tax exemption on some of the inputs imported like inorganic fertilizers. That is critical.[272]

---

[269] Interview ADT.
[270] Interview with ADM.
[271] Interview ADT
[272] Interview with ADM.

While the government transferred the responsibility of fertilizer purchase and distribution to private companies, it maintained the role of monitoring and regulation. At the district level, all stakeholders including donors, project coordinators, private sector, private companies, farmers and local leaders are coordinated through Joint Action Development Forum (JADF).[273]

8.4 Summary

While drafting the strategic plan of transformation agriculture in 2004, it was believed that solving the different problems in the farming sector would require collective effort from key actors including farmers (GoR 2004). The government therefore advocated for collective action in the form of partnerships with different key actors at the national level and farmers' organisations at the grassroots level. This chapter finds that the multilevel collective action approach used was beneficial for agriculture, and this aligns with Ostrom's thinking about multi-scalar forms of collective action, in her conceptualisation of polycentricity (Ostrom, 2010).

At the grassroots, increasingly farmers have become members of cooperatives, and SACCOs. As presented in this chapter, these organisations facilitate access to information, improved seeds, chemical fertilizers, extensions services, finance, and markets to rural farmers.[274] While we see a rise in membership of formal groups like cooperatives and SACCOs, farmers have also joined informal small farmers' associations and savings groups. Informal groups have been particularly important in attracting the groups of people more difficult to reach: women, older and low resourced farmers. Group membership reduces transaction costs of facing service providers and output buyers as well enabling farmers to hold service providers accountable for the services they provide (Poulton and Lyne 2009)

[273] Coordination at the district is discussed in Chapter 2 section 2

[274] These policies are discussed in detail in chapter 2.

As expected, SACCOs and saving groups were strongly linked to saving and access to credit. Additionally, SACCO members were likely to increase yield and engage in crop sales compared to non-members. Other studies have also shown the critical role of grassroots financial institutions in enabling agribusiness and facilitating increased productivity for farmers (Pesha et. al 2017)

Evidence provided in this chapter indicates that at an individual level, farmers make rational considerations when becoming group members. Similar to technology adoption, membership of farmers' organisations increased progressively over time and farmers who were not interested in these interventions did not take part. These membership organisations do not operate in a linear or easy to scale manner, and if one uses such a lens it would appear that they were slow to take off or even failing. If one considers this as part of an evolutionary process of generating a polycentric system of governance, which depends on an adequate support from vertical coordination being increasing replaced by horizontal coordination, then it requires a much longer time horizon to assess the complete impact. This nature of enquiry uses a different lens to that which regards the state as being 'authoritarian high modern' in its orientation as understood by Pritchard (2013) and Huggins (2009) who allege that the mechanism of policy implementation is through coercion, and farmers have no choice but to follow government orders.

Using a logistic regression analysis, this finds that age, land size, membership of a cooperative, use of improved seeds and fertilizers were strongly correlated to agricultural commercialisation. The strong link between adoption of improved seeds and fertilizers with commercialisation suggest that the CIP policy has had a positive impact on farmers' income. However, the extent to which intensification leads to increased commercialisation is subject to the size of landholdings. Farmers with very small land were found less likely to participate in produce markets. The majority of these farmers were found engaging in causal labour. In situations where the agricultural policy has limited potential to aid the required transition out of poverty, more comprehensive strategies are needed to provide alternative livelihoods for farmers. More coverage and better targeting of government social programs like the VUP could reduce vulnerability for farmers with limited land and alternative sources of income.

Rwanda has demonstrated considerable leadership in pursuit of agricultural development as demonstrated by intervention measures, a coordination role and unique policies. These features present the basis to argue that country has followed the pathway of a developmental state. The evidence presented in this thesis shows that before the intensification policy, input markets were thin and services to farmers were limited. Therefore, the government coordinated several complementary investments from different actors to facilitate growth in agriculture. The shift in relationships between the state, donor and the private sector displayed in this chapter aimed to focus the attention of the different actors on the national priorities.

Rwanda's processes of strengthening relationships with donors is commanded by: the country's ability to curved out its own development approach; developed innovative and inclusive institutions; enhanced implementation capacity; developed tools for monitoring performance; and aims to improve governance and implement a no corruption policy. Subsequently, this structure provides potential flexibility in facilitating Rwanda's relationships with donors. As argued by Whitfield Lindsay (2010) countries like Rwanda benefit from the ability to design coherent development strategy that increase government ability to defend their policies in aid negotiations.

Similar to donor engagement, Rwanda found an innovative way of nurturing and involving the private sector in agriculture. This is best exemplified by the national input distribution system where the government took on the initial financial burden and risk of input distribution as a proof of concept trial. The government imported fertilizers, which were distributed to farmers through a public-private partnership with agrodealers. Although input distribution was a huge burden to the government budget (80% of MINAGRI budget went to CIP in 2008), the model created fertilizer demand among farmers, demonstrated business potential in agriculture and built confidence and capacity in the private sector. By 2017, with increased capacity and confidence, the private sector had taken over the role of fertilizer distribution from government and was able to organise imports and distribute inputs to farmers with close monitoring and collaboration from the government. This chapter demonstrates that effective coordination and collective action in agricultural development requires commitment, trust, incentives and an enabling environment.

The following, concluding, chapter summarises the main research findings, drawing out the multi-faceted arrangements at every level that have driven the recent agricultural changes.

Chapter 9: Conclusion

My findings are discussed in Chapters 5-8. Chapter 5 analysed the processes of problem diagnosis, policy design and implementation and the outcomes for farmers. The following three chapters (6-8) then discussed my findings on the processes through which these outcomes were realised. Chapter 6 focused on the adoption of new seeds and chemical fertilisers and Chapter 7 on institutions for land and water management, whilst Chapter 8 examined my findings on the role of collective action in facilitating the effective implementation of policy reforms and the successful introduction of agricultural innovations. This conclusion summarises the main research findings of the thesis and reflects on their wider research and policy implications.

The central focus of this thesis has been to understand the processes by which agricultural problems are diagnosed, and policies designed and implemented, through the responses of smallholder farmers and other stakeholder. The question of what it takes to develop smallholder agriculture is one that is extensively discussed in the literature and among policy makers. This thesis has discussed why Rwanda prioritised agriculture, what policies were used to initiate growth and their impact on smallholder farmers. The research, which analyses agricultural development from 2000 to 2016, asked the question: 'What are the drivers of smallholder agricultural development in Rwanda?'

This was addressed through four sub-questions:

1) Why did Rwanda prioritise smallholder agriculture?
2) What mechanisms were used to stimulate agricultural change?
3) What was the impact, particularly on rural farmers?
4) To what extent did agricultural reforms influence agricultural productivity and commercialisation?

Given the complex nature of the research question, the scale of the agricultural reforms, and the agro-ecological and socioeconomic diversity of Rwanda, this research encompasses a diverse range of actors in multiple locations. This study interviews 288 rural smallholder farmers from 4 districts across Rwanda. In addition, a varied group of stakeholders, including policy makers, implementers, donors, and agro-dealers, was interviewed to understand the processes of agricultural change.

9.1 Summary of the main research results

This research has five main findings:

1) With the objectives of food self-sufficiency, poverty reduction, improved social and political stability, the principal driver of agricultural change was government policy reform, which had a technical, institutional and social dimension (Chapters 5, 6 and 7).
2) The inclusive institutional arrangements that were both top down and bottom up, created a positive response among farmers and led to ownership of the processes of change (Chapters 6,7 and 8).
3) Land tenure security led to collective action, which in turn led to the adoption of new technologies (Chapters 6, 7, and 8).
4) Technical and institutional changes led to increases in crop yield and commercialisation. Over 60% farmers say their lives are better compared to the time before the reforms, mainly because they have increased food and income (Chapters 5,6,7, and 8)
5) Farmers with very small landholdings and the elderly, constrained by limited resources, were likely not to engage with the new agricultural reforms. More comprehensive policies may be needed for this category of farmers.

Chapter 5 looks at why agriculture was prioritised and the policies developed to support smallholder food producers. It echoes previous findings (for example, Murindahabi, Li, and Ekanayake 2018; Nilsson 2018; Golooba-Mutebi 2014; IMF 2011) that show that the principal driver of agricultural change in Rwanda is a state-led policy. Agricultural change is founded on the sustained prioritisation of rural poverty reduction at a senior government level, which was facilitated by political stability over the period. This enabled people to feel safe and to be able to plan and invest in short- and long-term economic activities, and allowed policy reforms to be co-ordinated across departments. At the top political level, policymakers underscored the critical contribution of the Integrated Development Program (IDP) where ministers supported each other by advising on key development programs in various ministries. The chapter finds that the nature of the accommodations between state and society could be regarded as a case of total transformation (Migdal, 1994: 24), where the state uses processes of co-optation or subjugation of local social forces. The reason for this form of agricultural policy was to bring about institutional reform that would improve the chances of successful agricultural intensification by adopting a form of 'developmental coordination' (Dorward, 2009). The IDP did result in improving complementarity and collaboration during program accountability at the top-most level.

Effective institutional structures were also evident at other levels. Innovative institutions like the Joint Action Development Forum (JADF) at the district level and Sector Working Groups (SWG) in MINAGRI provided opportunities for different stakeholders to engage actively and contribute to policy dialogue and the implementation of agricultural change. These structures were complemented by effective personnel. On many occasions during this research, different people mentioned leadership while referring to a local leader, government official, a minister or the president, and how trust in leadership had been an important aspect of the agricultural development process.

This policy prioritisation, institutional and technical capacity allowed policy to be coherent yet flexible. Core problems could be diagnosed at a national level whilst contextual difficulties were also addressed. This combination of strong technical capacity and embedded autonomy (Evans, 1995), was a fundamental ingredient of policy success. My interviewees told me this required detailed analysis of the agricultural sector and close interaction between farmers, local leaders and policymakers to understand ‘on the ground’ issues that prevented growth. From discussions at multiple levels and through numerous poverty studies, it was evident that farmers lacked adequate information, knowledge, technologies, markets and incentives to increase food production (GoR 2002,IDS 2006).

To address the issues of low land productivity and rural poverty, crop intensification and commercialisation became the key policy focus. While this may be seen as a linear approach to agricultural development (Kim 2017), policy makers believed that once farmers had the right technologies and institutional support, they were likely to escape poverty and diversify economic activities. This would be achieved by ensuring that the advisory services provided guidance and hands on support to reduce information asymmetries. From less than 6% around 2000, 51% of farmers used improved inputs and 61% accessed advisory services in 2016. My findings confirmed that the majority of farmers observed real improvements to their agricultural activities, leading to better lives due to the increased availability of food, higher income and better housing.

Whilst political commitment is critical at a high level, policy frameworks also need to be founded on an inclusive institutional framework that invites different key players to support farmers, and must be sufficiently flexible to respond to specific constraints at farm level. All farmers were affected by environmental constraints but some in particular were restricted in terms of land size (especially the young) or by limited physical capability (especially the old).

Chapter 6 examines farmers’ response to the Intensification Program (CIP) policy. This study finds that more than 50% of farmers interviewed had adopted CIP promoted approaches for increased productivity either by using improved seeds, chemical fertilizers, line planting, and monocropping.

The process through which the agricultural policy was implemented was key. This not only included specific measures to encourage technology adoption (such as input subsidies) but reform of the entire context in which adoption occurs. The CIP program-built systems that enabled farmers to engage in collective action through land use consolidation, and access to improved seeds of the six prioritised crops (maize, cassava, banana, wheat, Irish potatoes and rice) and chemical fertilizers. Its success was underpinned by social and institutional change in the form of collective action at village level and a programme of land use consolidation to address the issue of land fragmentation. In contrast to land reform in Europe where land was swapped amongst different farmers (Keeler and Skuras 1990), the Rwandan model encouraged neighbouring farmers to conduct farming activities together, to decide on crops to be grown and methods to be used. The rationale of this approach was that once smallholders cooperated in this way, they would realise economies of scale and attract different services.

Most farmers now make crop choices after group meetings with fellow farmers, local leaders or an agronomist. This shift from traditional individual based systems to more collective action has encouraged group learning and the associated benefit of horizontal coordination, that also has the benefit of attracting more extension services and input suppliers.

Using statistical analysis of my data, I found that technology adoption depends upon multiple drivers, including the type of crop, access to extension services, cooperative membership, pre-existing level of commercialisation and farmers' wealth. Strongly performing and more commercialised agricultural sectors were also more likely to have more farmers engaging with new technologies. This means that sectors that were strong before reforms continued to outperform weaker ones after reforms.

Even within groups, farmers do not move at the same pace. This partly reflects initial reluctance to change by some farmers, as change is uncertain and risky. Different approaches had to be used to encourage adoption, including training, demonstration plots, meeting with agronomists and local leaders. Seeing fellow farmers prosper, and the potential for the new inputs seen in demonstration plots and farmers' fields, was most convincing for reluctant adopters. Local leaders often played a key role in co-ordinating farmers and promoting the use of improved seeds and fertilizers at group meetings. These gatherings demonstrate the importance of decentralised autonomy, local stewardship and farmer participation in encouraging ownership and contextual understanding of proposed technical changes.

Chapter 7 assesses the impact of the land and Water Users Associations (WUAs) policies on agriculture. Farmers who possess land titles (89%) have tenure security and Water Users Association (WUA) in marshlands led to better water management and increased yield.

The provision of tenure is a classic type of institutional reform that significantly reduces the transactions costs associated with agriculture, as it provides a strong sense of ownership in each household (North, 1990). Land tenure security is particularly important for Rwandans given the history of conflict and constant migration. Land reforms have resulted in landowners having title deeds, which farmers say has given then a sense of belonging and stability, although a comprehensive examination of the benefits will require a longer time horizon as institutional change is an evolutionary process. Contrary to Huggins (2012) and Pritchard (2013), my research finds that the key outcome of the land policy is that farmers valued feeling secure on the land, which in turn affected how they managed natural capital.

Farmers engage in various land management approaches to control soil loss on hillsides, including water ditches, trees, mulching, forestry, manure, composting, and terraces. As they felt secure on their own individual plots, farmers were more likely to engage in collective activities to protect the land. In most cases, farmers collectively build land infrastructure to comprehensively manage soil and water loss. Collective action was most evident in marshland where farmers manage irrigation schemes for rice production.

Rwanda has implemented a unique model, where cooperatives and water user associations (WUAs) jointly operated irrigation schemes. These farmer's organisations work to create and build horizontal coordination (Poulton, 2009), which is necessary for sustainable coordination of development policy, as agricultural strategies develop further.

The value of the WUA in terms of policy success lies not so much in the water itself, although this is central for agriculture, but in creating an institution that forges a form of collective action in the villages (Ostrom, 1990). While cooperatives support farmers to access to inputs and markets, WUAs are solely in charge of water. The WUA model introduced by the government in 2013 addressed issues of irrigation by decentralising the responsibility for scheme management from MINAGRI to water users. Assisted by the rules set by farmers, the WUA model has considerably improved water fees collection, communication, transparency, equitable water distribution, infrastructure management and productivity, mostly in rice irrigation marshlands.

Using statistical analysis of my data, I found that the factors that influence increased productivity are the age of a farmer, household size, and access to improved inputs, extension services, and commercialisation. Despite challenges associated with land quality and erosion, this chapter shows that most farmers have raised productivity, supported by government policies that facilitate the availability of high yielding inputs and advisory services in rural areas. The chapter also reveals that changes in agriculture are being made in an environmentally sensitive manner where collective action in natural resources management is upheld.

The link between my two research findings is the role of the government in acting as a convenor of collective action between different stakeholders, not just at the village level. Engaging actors to pull in the same direction was an essential part of Rwanda's success.

Chapter 8 examines the multilevel collective approaches used to plan and advance agricultural development.

The state and donors collaborated in program design and implementation. Through institutions like the Sector Working Group, various stakeholders, particularly donors, engaged in policy dialogue with MINAGRI that help refine policies and methods of implementation. This includes innovative incentives and the use of various Public Private Partnership (PPP) models to stimulate private sector engagement in agriculture. The dual presence of the private and public actors in input markets facilitated access to improved seeds and fertilizers for farmers through a network of close to 1000 distributors across the country (MINAGRI 2015).

At grassroots level, farmers were found to be members of formal organisations (cooperatives and SACCOS) and informal groups (farmers' associations and saving groups). These organisations have facilitated peer learning, access to information extension services inputs, finance and markets. Farming cooperatives were found to be instrumental in linking farmers to markets, which was crucial in a country where rural markets were functioning poorly.

About 67% of farmers engage in produce markets, which are driven by increased yield, better prices for produce and markets. Using statistical analysis of my data, I found that market participation was strongly correlated with the age of a farmer, size of landholding, cooperative membership, and the use of improved seeds and fertilizers. The strong correlation between the adoption of improved seeds and fertilizers with commercialisation implies a positive impact of CIP on farmers' income. However, the extent to which intensification leads to increased commercialisation is subject to the size of landholdings. Farmers who own very small land were found to be less likely to participate in produce markets. This explains why farmers in informal groups, who were found to have smaller land compared to cooperative members, were less likely to participate in produce markets.

Small groups were found to be more influential in providing information or access to extension services, inputs, and finance (in the case of saving groups), especially for the more difficult groups of people to reach like the poor (characterised by limited land) and women. As pointed out by Flynn and Sumberg (2018), small groups possess limited transformative potential, but they have low barriers to entry, making them more attractive to a wide range of community members. Given the important role of small groups in attracting the more challenging groups of people to reach, targeting these groups could facilitate the transition from activities undertaken to maintain livelihood levels at a 'survival' level to step out of poverty (Doward et al. 2006).

9.2 The contribution of the study

The contribution of this thesis to the literature is fourfold.

First, this thesis echoes the findings of other researchers who have underlined the importance of state intervention for agricultural development (Hazell et al. 2006; Timmer 2005; Dorward, Marrison, and Urey 2004; WDR 2008). My research suggests that this intervention has to take a particular form. Rwanda's experience indicates the need for a holistic approach as well as sustained long-term political commitment and a flexible and inclusive institutional framework.

Second, this thesis has reaffirmed findings from the existing literature regarding the importance of access to information, knowledge, productive inputs, extension services, finance and markets as key drivers of agricultural transformation. However, the thesis also supplements this literature by examining how and why these factors are relevant in agricultural innovation. It therefore demonstrates the value of understanding the precise processes through which policy reform is designed, implemented and understood at the local level, rather than simply focusing on policy outcomes at a national level.

Third, this research contributes to the debate of whether smallholder farming is a viable driver for agricultural transformation, particularly for African countries (Collier and Dercon 2014; Gollin 2014). Given a favourable policy back-drop my findings suggest that smallholders can succeed and are capable of improvements in productivity that yield economic gains. As the demand of more productive agricultural inputs increases and farmers increase income, this serves as basis for the development of other non-farm sectors.

One cannot underestimate the learning that has occurred at the national and grassroots level; in particular the effect of people's realisation that change was possible and the strength of connections to each other and the world beyond their village. The effects have also been psychological and aspirational. Attitudes to group learning, problem resolution and the outlook for agriculture have undergone a radical change.

In terms of policy design, this study has shown that the identification of appropriate development pathways, the formation of practical policy solutions, the creation of supportive institution frameworks and the generation of innovative solutions made available in the right place at the right time positively impacts farmers. Analysing the Rwandan state through the lens of a developmental state, provides a heuristic device that permits an analysis of state-led development policies in the face of poorly functioning markets.

The study underlines the critical importance of understanding the problems on the ground (Vorley, 2002). It shows that the CIP and land policy were complementary in motivating increased productivity among smallholder farmers. Formalising land tenure systems through titling increased tenure security for farmers, which in turn incentivized collective action, the use of improved inputs, and led to better land management.

The analysis of how the Rwandan state can be viewed as a case of total transformation(Migdal, 1994: 24), which uses processes of co-optation of local social forces in the face of prolonged civil war, allows a distinction to be drawn between the use of the term ‘developmental state’ in institutional economics – a requirement for state-led policy making – and how it is regarded as akin to ‘authoritarian high modernist’ in other disciplines in the social sciences. This distinction is crucial as it permits an exploration of how state-led policy is necessary to ensure ‘developmental coordination’ to improve markets and reduce transactions costs that prevent social agents from accessing resources and improving their incomes.

Fourth, the findings of this research respond to concerns raised by a group of authors Huggins (2017; 2012; 2009); Dawson and Sikor (2016); Pritchard (2013); and Ansoms (2009) who criticise Rwanda’s agricultural development model. My study responds to five of their main critiques, summarised below:

1. That the Rwandan state has followed an ‘authoritarian high modernist’ path, and has not permitted any policy debate during the design and implementation of the agricultural policies (Huggins 2017; 2009)
2. The objective of shifting from subsistence and multi-cropping systems to crop specialisation (CIP focus on 6 prioritised crops) and commercialisation has reduced crop diversity, which may lead to food insecurity (Huggins 2017; 2009; Dawson and Sikor 2016)
3. The government uses coercive measures during the implementation of the agricultural policies and there is a risk of farmers losing land due to noncompliance (2017; 2012; 2009); Dawson and Sikor (2016); Pritchard (2013); and Ansoms (2009)
4. The Land registration and CIP policy have led to tenure insecurity (Huggins 2017; Pritchard 2013)
5. The impact of the agricultural and land policies has been detrimental to farmers causing food insecurity, landlessness and poverty (Dawson and Sikor 2016).

Regarding the issue of the lack of policy dialogue that was raised by Huggins (2017; 2009), my research finds that policy design and implementation is an interactive process that involved actors at many levels. Starting from the

Urugwiro dialogue, my study notes that agricultural prioritisation was an outcome of two-year long deliberations that brought together different actors including politicians, practitioners, scholars, and community representatives, to formulate Rwanda's Vision 2020. Subsequently, institutions such as Citizen Assemblies ('inteko'), Community Score Cards, 'Isibo' (a small unit of a community organisation), and National Dialogue Council, were commissioned by the government to bring policy makers and citizens closer together, to engage in conversations that generated policies and provided feedback. In addition to these interconnected institutions, Chapters 6,7, and 8 of this thesis show close interaction between farmers, policy makers and local leaders during village meetings. It is through these interconnected organisations that farmers' voices are heard. Thus, the claim that there is 'no policy discussion' cannot be assumed to be correct.

On the question of whether shifting from subsistence and multi-cropping systems to specialisation (CIP focuses on six prioritised crops), monocropping and commercialisation has reduced crop diversity, evidence from my research shows that the crops grown in Rwanda remain substantially unchanged. Farmers grow more than 10 types of crops (Chapter 5 page 202; National Institute of Statistics 2017, page 19), which is the same as before the reforms. Although most farmers practice monocropping, they can afford to grow a variety of crops on different plots since land is fragmented. For instance, only about 30% of farmers produced a single crop in season A and B 2016, while the rest harvested a variety of crops. In this case, land fragmentation allows for crop diversification, while enabling participation in land use consolidation. Although my study shows a gradual rise in numbers of farmers growing the CIP prioritised crops, MINAGRI data shows radical increases of output of these crops at the national level, which indicate increases in productivity. This factual picture is at odds with the assertions made by Huggins (2017; 2009) and Dawson and Sikor (2016).

The allegation made by the authors that the government uses coercive measures during implementation of their agricultural policies is not borne out by the results of this study. Contrary to what would be expected in a situation where policy is mainly driven by coercion, adoption of the new technologies was gradual, with farmers taking up the technologies over a 10-year period. Furthermore, only 50% of the farmers have chosen to engage with the policy and none of the remaining 50% have lost their land as a result of their decision to not engage. Furthermore, when the farmers who have complied with the policy, in varying degrees, were asked about their reasons for doing so, their responses showed a positive understanding of the benefits of the policy and individual decision to engage. When it came to the actual adoption of the new technologies, the most convincing factor according to farmers' responses was seeing the potential of the new inputs to increase yield.

There is no evidence in my study to suggest land grabbing, elite capture, or land confiscation by the government because of the failure to adopt the CIP prioritised crops. Huggins (2017) and Pritchard (2013) indicate that the land and agricultural policy have undermined tenure security for farmers. On the contrary, all farmers indicated that land titling had been beneficial and increased tenure security. When asked about issues concerning land, none of the farmers indicated that the process of land registration was unfair or that there was an issue with land use consolidation. Instead, farmers raised concerns about land scarcity, infertility, soil erosion, landlessness, and family issues concerning ownership that led to delays in receiving titles.

When assessing the impact of the different policies, my study finds contrary results to those shown by Dawson and Sikor (2016). Over the period of the study, evidence in my research shows that the majority of farmers increased crop yield and engaged in commercial activities. Furthermore, most say they have a better life compared to 2000. My statistical analysis shows a strong correlation between adoptions of improved seeds and fertilizers with increased productivity and commercialisation, which suggest that the crop intensification policy has had positive impact on food production and income for farmers.

Looking at the period between 2000 and 2016, this research shows that the agricultural policy has been effective in supporting increased productivity for a majority of farmers. However, the research has also flagged some of farmers' pressing concerns, including land scarcity, climate-related issues (especially drought), and the vulnerability of those who lack the physical capacity to keep up with the drudgery of farming. The question arises whether this same policy approach will be brought to bear on the most pressing challenges which farmers are now facing.

However, there is no silver bullet. Agricultural development is complex and the process is underpinned by experimentation, flexibility, feedback mechanisms, collective action and coordination among different partners. This allows policy to vary by context to reflect the heterogeneous nature of smallholder agriculture. It requires that 'developmental coordination' is sustainable by moving from vertical coordination to horizontal coordination, and this will require increased cooperation and improved governance, that requires careful sequencing of policy reforms (Poulton, 2009)

Future studies may look at any of these issues – land scarcity, climate change, demographics – and it will be important to see whether continued growth in agriculture can be maintained. Equally important is whether the policy approach used stands the test of time and continues to deliver improved well-being and economic growth for smallholder farmers. Further research could also examine how Rwanda could build on the current model and look at alternative pathways of agricultural development that including high value crop production.

Bibliography

Aarnoudse, Eefje, Alvar Closas, and Nicole Lefore. 2018. 'Water User Associations: A Review of Approaches and Alternative Management Options for Sub-Saharan Africa'. IWMI working Paper 180

Abbott, John. 1962. 'The Role of Marketing in the Development of Backward Agricultural Economies'. Journal of Farm Economics 44 (2): 349-362. https://doi.org/10.2307/1235835.

Abebaw, Degnet, and Mekbib G. Haile. 2013. 'The Impact of Cooperatives on Agricultural Technology Adoption: Empirical Evidence from Ethiopia'. Food Policy 38 : 82–91.

Abrahamsen, Rita. 2004.'The Power of Partnerships in Global Governance' Third World Quarterly 25 (8):1453–67.

Acemoglu, Daron, and James Robinson. 2008. 'The Role of Institutions in Growth and Development Daron Acemoglu James Robinson'. Working Paper No 10: Commision of Growth and Development.

Akinwumi A. Adesina Moses M. Zinnah. 1993. 'Technology Characteristics, Farmers' Perceptions and Adoption Decisions: A Tobit Model Analysis in Sierra Leone'. Agricultural Economics, 9 (4): 297-311.

AFI. 2014.'Rwanda's Financial Inclusion Success Story Umurenge SACCOs'. Alliance for Financial Inclusion Case Study.

African Union. 2006. 'AU African Fertilizer Summit - Abuja Declaration on Fertilizer for the African Green Revolution'.

AGRA. 2018. 'Africa Agriculture Status Report 2018: Catalyzing Governance Capacity to drive Agricultural Transformation'. AGRA Report.

Akinola, Adeoye. 2018. 'Women, Culture and Africa's Land Reform Agenda'.
Frontiers of psychology https://doi.org/10.3389/fpsyg.2018.02234

Alexander, Corinne, and Thuv Mellor. 2005. 'Determinants of Corn Rootworm Resistant Corn Adoption in Indiana'. AgBioForum, 8(4): 197-204.

Ali, Daniel, Klaus Deininger, and Markus Goldstein. 2014. 'Environmental and Gender Impacts of Land Tenure Regularization in Africa: Pilot Evidence from Rwanda'. Journal of Development Economics 110: 262-275

Almekinders, Conny. 2000. 'The importance of Informal Seed Sector and its relation with the legislative framework'. Paper presented at GTZ-Eschborn, Technology and Agrarian Development Wageningen University

Ansoms, An. 2009. 'Faces of Rural Poverty in Contemporary Rwanda: Linking Livelihood Profiles and Institutional Processes'. PhD in Applied Economics Université d'Anvers.

Asiama, Obeng, Mark Bennett, and A Zevenbergen. 2017. 'Land Consolidation on Ghana's Rural Customary Lands: Drawing from The Dutch, Lithuanian and Rwandan Experiences'. Journal of Rural Studies

Atkinson, R, and J Flint. 2001. 'Accessing Hidden and Hard-to-Reach Populations: Snowball Research Strategies'. Social Research Update, no. 33.

Awotide, Bola Amoke, Aziz A. Karimov, and Aliou Diagne. 2016. 'Agricultural Technology Adoption, Commercialization and Smallholder Rice Farmers'

Welfare in Rural Nigeria'. Agricultural and Food Economics 4 (1): 3. https://doi.org/10.1186/s40100-016-0047-8.

Bagi, Faqir. 2008. ‘Relationship Between Farm Size and Economic Efficiency: An Analysis of Farm-Level Data from Haryana (India)’. Canadian Journal of Agricultural Economics/Revue Canadienne d’agroeconomie 29: 317–26. https://doi.org/10.1111/j.1744-7976.1981.tb02086.x.

Baltzer, Kenneth and Henrik, Hansen. 2011. 'Agricultural Input Subsidies in Sub-Saharan Africa'. International Development Cooperation, DANIDA.

Banful, Afua. 2010. 'Old Problems in the New Solutions?' IFPRI Discussion Paper 01002, Washington D.C, IFPRI.

Barrett, Christopher. 2008. 'Smallholder Market Participation: Concepts and Evidence from Eastern and Southern Africa'. Food Policy 33 (4): 299–317.

Bates, Robert H. 1981. 'Markets and States in Tropical Africa: The Political Basis of Agricultural Policies'. 2005th ed. University of California Press.

———. 1995. ‘Social Dilemmas and Rational Individuals: An assessment of new institutionalism’. In Harris, John, Hunter Janet, and Colin M. Lewis (Ed) The New Institutional Economic and Third World Development'. Routledge

Bezemer Dirk,and Derek D. Headey. 2008. 'Agriculture, Development, and Urban Bias'. World Development 36 (8): 1342–64.

Binswanger, Hans, Shahidur Khandker, and Mark Rosenzweig. 1993. 'How Infrastructure and Financial Institutions Affect Agricultural Output and Investment in India'. Journal of Development Economics 41 (2): 337–366. https://doi.org/10.1016/0304-3878(93)90062-R.

Blank, G. Herbert G, Clifford M. Mutero, H. Murray-Rust 2002. The Changing Face of Irrigation in Kenya: Opportunities for Anticipating Changes in Eastern and Southern Africa. International Water Management Institute.

Blarel, Benoit, Peter Hazell, Frank Place, and John Quiggin. 1992. 'The Economics of Farm Fragmentation: Evidence from Ghana and Rwanda'. The World Bank Economic review, 6 (2): 233-254

Bolton, Laura. 2019. 'Economic Impact of Farming Cooperatives in East Africa." Institute of Development Studies.

Bonnen, James. 1998. 'Agricultural Development: Transforming Human Capital, Technology, and Institutions'. In Eicher Carl and John Staatz (Ed) International Agricultural Development,. Johns Hopkins University Press. (271-285).

Boudreaux, Karol. 2009. 'Land Conflict and Genocide in Rwanda' The Electronic Journal of Sustainable Development 1 (3)

Booth, David 2000. ‘Development as a Collective Action Problem: Addressing the real Challenges of African Governance’. ODI Study

Booth David, Brian Cooksey Frederick, Golooba-Mutebi and, Karuti Kanyinga 2014. 'East African Prospects An update on the political economy of Kenya, Rwanda, Tanzania and Uganda'. ODI report

Booth, Davide and Fredrick Golooba-Mutebi. 2012. 'Developmental Patrimonialism? The Case of Rwanda'. African Affairs 111 (444): 379–403. https://doi.org/10.1093/afraf/ads026.

Branch, Adam and Zachariah Cherian Mampilly 2005. 'Winning the War, but Losing the Peace? The Dilemma of SPLM/A Civil Administration'. The Journal of Modern African Studies, 43 (1):1-20. https://www.jstor.org/stable/3876257

Brown, Hannah. 2015. 'Global Health Partnerships, Governance, and Sovereign Responsibility in Western Kenya'. Journal of American Ethnological Society 42 (2): 340–55.

Bruce, John. 2007. 'Drawing a Line under the Crisis: Reconciling Returnee Land Access and Security in Post Conflict Rwanda'. Working Paper, Humanitarian Policy Group and Overseas Development Institute (ODI).

Bryceson, Deborah, Shailaja Fennell, Prabirjit Sarkar, and Ajit Singh. 2010. 'Globalisation, Structural Adjustment and African Agriculture: Analysis and Evidence'. Centre for Business Research, University of Cambridge. http://core.ac.uk/download/pdf/12032626.pdf.

Bryman, Alan. 2002. 'Social Research Methods, 4rd Ed'. Oxford University Press.

Bukenya, Richard, and Ramzy Magambo. 2016. 'Study on Access to Formal Financial Credit Services by smallholder rural farmers for Agricultural Investment: Struggling option to rural development in uganda'. Proceedings of ISER International Conference, Auckland, New Zealand

Buruchara, Robin, Louise Sperling, Peter Ewell, and Roger Kirkby. 2003. 'The Role of Research Institutions in Seed-Related Disaster Relief: Seeds of Hope Experiences in Rwanda'. Disasters 26 (January): 288–301. https://doi.org/10.1111/1467-7717.00207.

Byiringiro, Fidele, and Thomas Reardon. 1996. 'Farm productivity in Rwanda: effects of farm size, erosion, and soil conservation investments'. Agricultural Economics 15: 127-136.

CAADP. 2014. ' 2014 Year of Agriculture and Food Security'. African Union Commission Issue 2.

———. 2017. 'The 2017 Progress Report to the Assembly Highlights on Intra-African Trade for Agriculture Commodities and Services: Risks and Opportunities'. CAADP Report.

Carr, J. Stephen. 2001. 'Changes in African Smallholder Agriculture in the Twentieth Century and the Challenges of the Twenty-First'. African Crop Science Journal 9(1): 331-338.

———.1989. 'Technology for Small-Scale Farmers in Sub-Saharan Africa: Experience with Food Crop Production in Five Major Ecological Zones Stephen'. World Bank Technical paper (109)

Carter, Michael R. 2008. 'Inducing Innovation: Risk Instruments for Solving the conundrum of rural finance'. Keynote Paper Prepared for the 6th Annual Conference of the Agence Française de Développement and The European Development Network

Chakravarti, A. K. 1973. 'Green Revolution in India'. Annals of the Association of American Geographers 63 (3): 319–30. https://doi.org/10.1111/j.1467-8306.1973.tb00929.x

Chalmers, Johnson. 1982. MITI and the Japanese Miracle: The Growth of Industrial Policy, 1925-75. University press, Stanford

Campbell, David, Jennifer Olson, and Len Bell 1993 'Population pressure, agricultural productivity and land degradation in Rwanda'. An agenda for training Collaborative Research Analysis'. Rwanda Society-environmental EProject. Working paper 1

Clay, Daniel C. 1998. 'Sustainable Intensification in the Highland Tropics: Rwandan Farmers' Investments in Land Conservation and Soil Fertility'. Michigan State University." The University of Chicago

Clay, Daniel C and Laurence Lewis A. 1990. 'Land Use, Soil Loss and Sustainable Agriculture in Rwanda'. Human Ecology 18 (2) 147-161.

Clay, Daniel C, Fidele Byiringiro, Jaakko Kangasniemi, Thomas Reardon, Bosco Sibomana, David Uwamariya, and Tardif Douglin. 1995. 'Promoting Food Security in Rwanda Through Sustainable Agricultural Productivity'. Department of agriculture and economic, Michigan.

Clover, Jenny. 2003. 'Food Security in Sub- Saharan Africa'. Africa Security Review 12 (1): 5–15.

Cohen, John. 1980. 'Land Tenure and Rural Development in Africa'; In: Robert H Bates and Michael F Lofchie ed. Agriculture Development in Africa, Issue for Public Policy. New York: Praeger publisher.

Collier, Paul, and Stefan Dercon. 2014. 'African Agriculture in 50 Years: Smallholders in a Rapidly Changing World?' World Development 63 : 92–101. Elsevier Ltd

Conley, Timothy, and Christopher Udry. 2001. 'Social Learning through Networks: The Adoption of New Agricultural Technologies in Ghana'. American Journal of Agricultural Economics 83 (3): 668-673

Conway, Gordon. 2014. 'On Being a Smallholder Farmer'. In: Peter B. R. Hazell and Atiqur Rahman. New Direction for Smallholder Agriculture. United Kingdom: Oxford University Press.

Corlett, Sandra and Sharon Mavin. 2019. 'Reflexivity and Researcher Positionality'. In: The SAGE Handbook of Qualitative Business and Management Research Methods: History and Traditions

Crawford, Eric W, T S Jayne, and Valerie A Kelly. 2006. 'Alternative Approaches for Promoting Fertilizer Use in Africa'. Agriculture and Rural Development Department, World Bank

Cresswell, John.W. 1994. 'Research design: Qualitative & quantitative approaches'. Sage Publications, Inc.

Creswell, JohnW, and Plano Clark. 2011. 'Designing and Conducting Mixed Methods Research'. SAGE Publications. 2nd Ed. Thousand Oaks, CA: SAGE Publications.

Crisafulli, Patricia, and Andrea Redmond. 2012. 'Rwanda. Inc. How a Devastated Nation Became An Economic Model For The Developing World'.

CTA. 2014. 'Seed Systems, Science, and Policy in East and Central Africa'. Policy Brief http://www.cta.int/images/1832_PDF.pdf.

Daniel C. Clay, Fidele Byiringiro, Jaakko Kangasniemi, Thomas Reardon, Bosco Sibomana, David Uwamariya, and Tardif Douglin. 1995. 'Promoting Food Security in Rwanda Through Sustainable Agricultural Productivity'. Department of agriculture and economic, Michigan.

Darkoh, Michael BK. 1989. The Underlying Causes of the Food Crisis in Africa'. Transafrican Journal of History, 18:54-79. Stable URL: https://www.jstor.org/stable/24328704 Accessed: 22-02-2019 15:55 UTC

Darkoh, Michael BK and Mohamed Ould-Mey. 1992. 'Cash Crops versus Food Crops in Africa: A Conflict between Dependency and Autonomy'. Transafrican Journal of History 21:36–50. Stable URL: http://www.jstor.org/stable/24520419

Dawson, Neil, Adrain Martin, and Thomas Sikor. 2016. 'Green Revolution in Sub-Saharan Africa: Implications of Imposed Innovation for the Wellbeing of Rural Smallholders;. World Development Vol. 78, Pp. 204–218, 2016" 78: 204–18.

De Janvry, Alain, and Elisabeth Sadoulet. 2010. 'Agricultural Growth and Poverty Reduction: Additional Evidence'. The World Bank Research Observer 25 (1): 1–20.

De Soto, Hernando. 2000. The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere Else. New York: Basic Books.

Deininger Klaus. 2004. Klaus Deininger, 'Land Policies for Growth and Poverty Reduction: Key Issues and Challenges Ahead'. Inter-Regional Special Forum on the Building of Land Information Policies in the Americas. World Bank

Deininger, Klaus. 2014.'Securing Land Rights for Smallholder Farmers'. In Hazzel Peter and Rahman Atiqur: A New Direction for Smallholder Agriculture. Oxford University Press.

Deininger, Klaus, Daniel Ayalew Ali, Stein Holden, and Jaap Zevenbergen. 2008. "Rural Land Certification in Ethiopia: Process, Initial Impact, and Implications for Other African Countries'. World Development 236(10) 1786-1812.

Delgado, Christopher.1995. 'Africa's Changing Agricultural Development Strategies: Past and Present Paradigmsas a Guide to the Future Food, Agriculture, and the Environment'. Discussion Paper 3

Delgado, Christopher L. and John W. Mellor. 1984. 'A Structural View of Policy Issues in African Agricultural Development'.. American Journal of Agricultural Economics 66, (5): 665-670

Deressa, Temesgen, Rashid Hassan, Claudia Ringler, Tekie Elemu, and Yesuf Mahmud. 2009. 'Determinants of Farmers' Choice of Adaptation Methods to Climate Change in the Nile Basin of Ethiopia'. Global Environmental Change 19(2) 248-255

Dhawan, B D. 1979. 'Trends in Tubewell Irrigation'. Economic and Political Weekly 14 (51/52).

Diao, Xinshen, Godfrey Bahigwa, and Pradesh Angga. 2014. 'The Role of Agriculture in Fast-Growing Rwanda Economy: An Assessment of Growth Alternatives'. IFPRI discussion papers 1363, International Food Policy Research Institute (IFPRI). A Journal of Interdisciplinary Studies Volume 16, Number 4, March 1995

Diemer, Geert. 2009. 'Sustainable Crop Water Control: Organizational Requirements'. Rural Sector Support Project Rwanda

DFID. 2005. "Growth and Poverty Reduction: The Role of Agriculture." Department For International Development, Policy Paper.

Dorosh, Paul, Hyoung-Gun Wang, Liang You, Emily Schmidt. 2010. 'Crop Production and Road Connectivity in Sub-Saharan Africa A Spatial Analysis'. World Bank Policy Research Working Paper No 53385 Series.

Dorward, Andrew. 2009.'Rethinking Agricultural Input Subsidy Programmes in a Changing World'. Paper prepared for the Trade and Markets Division. Food and Agriculture Organization of the United Nations

Dorward, Andrew and Ephraim Chirwa. 2011. The Malawi agricultural input subsidy programme: 2005/06 to 2008/09, International Journal of Agricultural Sustainability 9:(1): 232- 247, DOI: 10.3763/ijas.2010.0567

Dorward, Andrew Jonathan Kydd, Colin Poulton and Dirk Bezemer. 2009. Coordination Risk and Cost Impacts on Economic Development in Poor Rural Areas, The Journal of Development Studies, 45:7, 1093-1112, DOI: 10.1080/00220380802550277

Dorward, Andrew, Jonathan Kydd, Jamie Morrison, and Ian Urey. 2004. "A Policy Agenda for Pro-Poor Agricultural Growth" World Development 32 (1): 73–89.

Doss, Cheryl. 2001. 'How Does Gender Affect the Adoption of Agricultural Innovations? The Case of Improved Maize Technology in Ghana'. Agricultural Economics 25 (1): 27–39. https://doi.org/10.1016/S0169-5150(00)00096-7.

——— 2003. 'Understanding Farm-Level Technology Adoption: Lessons Learned from CIMMYT's Micro Surveys in Eastern Africa'. Economics Working Paper 03-07.

Doss, Cheryl R., W. M. Mwangi, Hugo Verkuijl, and Hugo De Groote. 2003. 'Adoption of Maize and Wheat Technologies in Eastern Africa: A Synthesis of the Findings of 22 Case Studies'. http://repository.cimmyt.org/handle/10883/1037.

Easter, William, and Slim Zekri. 2004. "Easter, K.W.; Zekri, S. 2004. 'Reform of Irrigation Management and Investment Policy in African Development. South African Journal of Economic and Management Sciences 7(4): 652-663'.

Eicher, Carl. 2003. "Flashback: Fifty Years of Donor Aid to African Agriculture The Sustainable Agriculture and Natural Resource Management (SANREM) Knowledgebase

Eicher, Carl, and John Staatz. 1985. Food Security Policy in Sub-Saharan Africa Https://Ageconsearch.Umn.Edu/Bitstream/182560/2/IAAE-CONF-189.Pdf.

Ellis, Frank. 2005. 'Small Farms, Livelihood Diversification, and Rural–Urban Transitions: Strategic Issues in Sub- Saharan Africa'. Research Workshop: The Future of Small Farms. Food Policy Research 2020 initiative.

Evans, Alison, Laure-Hélène Piron, Zaza Curran, and Ruth Driscoll. 2006. 'Independent Evaluation of Rwanda's Poverty Reduction Strategy 2002-2005'. Institute of Development Studies (IDS) and Overseas Development Institute (ODI)

Evans, Peter. 1996. 'Government Action, Social Capital and Development: Reviewing the Evidence on Synergy'. World Development, 24 (6): 1119–1132.

———.1989. 'Predatory, Developmental, and Other Apparatuses: A Comparative Political Economy Perspective on the Third World State'. Sociological Forum 4 (4): 561–87. https://doi.org/10.1007/BF01115064.

———.1995. 'Embedded Autonomy: States and Industrial Transformation: States, Firms and Industrial Transformation'. Princeton University Press

FAO. 1978. 'The State of Food and Agriculture'. Food And Agriculture organisation Report.

———. 1999. 'An Interactive Multiple-Criteria Analysis Tool World Soil Resources' Reports 87 AEZWIN.
———. 2003. 'The Design of Land Consolidation Projects in Central and Eastern Europe'. FAO Land Tenure Studies 6
———. 2004. "'Smallholders, Globalization and Policy Analysis', in J.; Taniguchi Dixon, K.; Wattenbach, H.; Tanyeri-Arbur, A. (Ed.), (AGSF Occasional Paper 5 Edn.; Rome: Food and Agriculture Organization of the United Nations.
———. 2009. 'The Technology Challenge. High Level Expert Forum. How to Feed the World'. Food and Agriculture Organization of the United Nations
———2018. 'The State of Food Security and Nutrition in the World 2018. Building Climate Resilience for Food Security and Nutrition'. Food and Agricultural Organization of the United Nations: Rome.
FARA, 2014. 'Science agenda for agriculture in Africa (S3A): 'Connecting Science to transform agriculture in Africa'. Forum for Agricultural Research in Africa (FARA), Accra, Ghana.
Farmer, H.B 1981. 'The 'Green Revolution' in Southern Asia'. Geography Association 66 (3): 202–207.
Fatima and Yoshida 2018. 'Revisiting the Poverty Trend in Rwanda 2010/11 to 013/14'. World Bank Policy Research Working Paper 8585 http://documents.worldbank.org/curated/en/137651536845936223/pdf/WPS8585.pdf
Feder, Gershon. 1988. 'Land Policies and Farm Productivity in Thailand'. World Bank report.
Feder, Gershon, Richard Just, and David Zilberman. 1985. 'Adoption of Agricultural Innovations in Developing Countries'. A Survey Economic Development and Cultural Change 33 (2) 255-298. http://www.jstor.org/stable/1153228.
Feed the Children. 2011. 'Comprehensive Assessment of Extension Services in Rwanda'. Discussion Paper, United States Agency for International Development (USAID) project Modernizing Extension and Advisory Services' (MEAS). www.meas-extension.org
Fennell, Shailaja. 2009. 'State Fragility and African Agriculture'. In Conference on Moving Towards the European. http://erd.eui.eu/media/BackgroundPapers/ERD-Background_Paper
Fernando, Joseph L. 2013. 'Agriculture and Rural Development in Malasia and Kenya and the Politics of Policy'. In Asian Tigers and African Lions: Comparing the Development Performance of Southeast Asia and Africa. Edited by Bernard Berendsen Ton Dietz, Henk Schulte Nordholt and Roel van Der Veen.
Ferris, Shaun, Peter Robbins, Rupert Best, Don Seville, Abbi Buxton, Jefferson Shriver, and Emily Wei. 2014. 'Linking Smallholder Farmers to Markets and the Implications for Extension and Advisory Services'. MEAS Discussion Paper
FinScope. 2012. 'Financial Inclusion in Rwanda 2008-2012'. Alliance for Financial Inclusion (AFI)
———. 2016. 'Financial Inclusion in Rwanda 2016'. Alliance for Financial Inclusion (AFI)
Flynn, Justin, and James Sumberg. 2018. 'Are Savings Groups a Livelihoods Game Changer for Young People in Africa?' Development in Practice 28 (1): 51–64. https://doi.org/10.1080/09614524.2018.1397102.

Foster, Vivien. 2008. 'Africa Infrastructure Country Diagnostic: Overhauling the Engine of Growth: Infrastructure in Africa Infrastructure In Africa'. World Bank Report
Frankel, Francine. 1971. 'India's Green Revolution: Economic Gains and Political Costs.' Princeton University Press, Pp. 232
Funnell, D.C. 1988. 'Crisis in Africa: The Agrarian Dimension'. Geography 73 (1): 54-59 https://www.jstor.org/stable/40571343.
Gabre-Madhin, Eleni. 2009. 'A Market for All Farmers: Market Institutions and Smallholder Participation'. Center of Evaluation for Global Action Working Paper Series Agriculture for Development Paper No. AfD-0903
http://escholarship.org/uc/item/3k49r747.
Gaffney, Jim, Jennifer Anderson, Cleve Franks, Sarah Collinson, John MacRobert, Worede Woldemariam, and Marc Albertsen. 2016. 'Robust Seed Systems, Emerging Technologies, and Hybrid Crops for Africa'. Global Food Security 9 : 36–44.
Gao, Liangliang, Dingqiang Sun, and Jikun Huang. 2017. 'Impact of Land Tenure Policy on Agricultural Investments in China: Evidence from a Panel Data Study'. China Economic Review 45
Gbetibouo, Mathurin, Christopher L. Delgado. 1984. 'Lessons and Constraints of Export crop-led growth: Cocoa in Ivory Coast'. In political economy of Ivory Coast Ed Zartman W and Delgado christipher, Preager publishes
Girma, Gezimu Gebre, Hiroshi Isoda, Dil Bahadur Rahut, Yuichiro Amekawa, Hisako Nomura 2019. 'Gender differences in agricultural productivity: evidence from maize farm households in southern Ethiopia' Geojournal https://link.springer.com/article/10.1007%2Fs10708-019-10098-y
Ghatak, Subrata, and Ken Ingersent. 1984. 'Agriculture and Economic Development'. Baltimore MD, Johns Hopkins, University Press.
Gollin, Douglas, Stephen Parente and Richard Rogerson, 2002. 'The Role of Agriculture in Development'. American Economic Review, 92(2): 160-164.
Gollin, Douglas. 2014. 'Smallholder Agriculture in Africa: An overview and implications for policy'. Food and agriculture working paper
Golooba-Mutebi Fredrick 2014. 'Political Economy of Agriculture Policy in Africa: Has CAADP made a difference? A Rwanda case Study'. Future Agricultures, Working Paper 078
GoR 2000a. 'Interim Poverty Eradication Strategic Paper'. Government of Rwanda, Ministry of Finance and Economic Planning
———. 2000b. 'Rwanda Vision 2020'. Government of Rwanda
———. 2002. 'Poverty Reduction Strategic Paper'. Government of Rwanda Ministry of Finance and Economic Planning
———. 2004a. 'National Land Policy'. Ministry of Lands, Environment, forests, water and mines.
———. 2004b.'Strategic Plan for Agricultural Transformation in Rwanda PSTA 1'. Government of Rwanda, Ministry of Agriculture and Animal resources
———. 2005. 'Organic Law Determining the Use and Management of Land in Rwanda 2005'. Government of Rwanda
———. 2006a. 'Evaluation of General Budget Support 1994-2004'. Government of Rwanda Ministry of Finance and Economic Planning
———. 2006b. 'National Policy on Promotion of Cooperatives'.

———. 2006c. 'Making Decentralized Service Delivery Work: Putting the People at the Center of Service Provision'. A Policy Note
———. 2006d. 'Rwanda Aid Policy'. Government of Rwanda Ministry of Finance and Economic Planning
———. 2007. 'Strategy for Development Fertilizer Distribution Systems in Rwanda'. Government of Rwanda, Ministry of Agriculture and Animal resources
———. 2008. 'Economic Development & Poverty Reduction Strategy 2008 2012'.
———. 2010. 'Rwanda Irrigation Master Plan'. Government of Rwanda, Ministry of Agriculture and Animal resources
———. 2011a. 'Rwanda Local Development: VUP Report 2010-2011'.
———. 2011b. 'The Third Integrated Household Living Conditions Survey (EICV3)2010/2011'. Government of Rwanda Ministry of Finance and Economic Planning
———. 2011c. 'Ministry of Agriculture and Animal Resources, Annual Report 2010/2011'. Government of Rwanda
———. 2013. 'Economic Development and Poverty Reduction Strategy 2013-2018', Government of Rwanda, Kigali.http://www.edprs.rw/content/edprs-2.
———. 2014. The Third Integrated Household Living Conditions Survey (EICV3)'. Main Indicators Report National Institute of Statistics of Rwanda.
Green, Jennifer, Valerie Caracelli, and Grahan Wendy. 1989. 'Toward a Conceptual Framework for Mixed-Method Evaluation Designs'. Educational Evaluation and Policy Analysis, 11(3): 255-274 http://epa.sagepub.com/content/11/3/255.full.pdf+html.
Hall, A. 2006. 'Public-Private Sector Partnerships in a System of Agricultural Innovation: Concepts and Challenges'. International Journal of Technology Management and Sustainable Development 5(1).
Harris, Andrea, Brenda Stefanson, and Mwray Fulton. 2005. 'New Generation Cooperatives and Cooperative Theory'. Journal of Cooperatives, 11:15-28
Harris, John, Hunter Janet, and Colin M. Lewis. 1996. 'The New Institutional Economic and Third World Development'. Routledge
Harrison. 1987. 'The Greening of Africa'. London Palading Grafton Book Cited in Kangasniemi, (1998) People and Bananas on Steep Slopes: Agricultural Intensification and Food Security under Demographic Pressure and Environmental Degradation in Rwanda, Ph.D. Dissertation, Department of Agricultural Economics, Michigan State University.
HarvestChoice. 2010. 'Agro-Ecological Zones of Sub-Saharan Africa'. International Food Policy Research, Institute University of Minnesota. http://harvestchoice.org/node/8853.
Havnevik, Kjell, Deborah Bryceson, Lars-Erik Birgegard, Prosper Matondi, and Atakelte Beyene. 2007. 'African Agriculture and the World Bank Development or Impoverishment?' Policy Dialogue no. 1 The Nordic Africa Institute, Uppsala, Sweden
Hayami, Yujiro, and Vernon Ruttan. 1971. 'Agricultural Development: An International Perspective'. Baltimore MD: Johns Hopkins University Press 367pages.

Hazell, Peter. 2005. 'The Role of Agriculture and Small Farms in Economic Development." Research Workshop: The Future of Small Farms'. Food Policy Research 2020 initiative, 23-36.
Hazzel Peter and Rosemary C 1991. 'The Green Revolution Reconsidered: The Impact of High Yielding Rice Varieties in South India'. American Journal of Agricultural Economics 75(1)
Hazell, Peter and Diao Xinshen. 2005. 'The Role of Agriculture and Small Farms in Economic Development'. In The Future of Small Farms, Research workshop, FPRI 2020 Vision Initiative pg1–17.
Hazell, Peter, Colin Poulton, Steve Wiggins, and Andrew Dorward. 2006. 'The Future of Small Farms: Synthesis Paper'. Rimisp-Latin American Center for Rural Development
Helfand, Steven, and Mathew Taylor. 2017. 'The Inverse Relationship between Farm Size and Productivity: Refocusing the Debate'. Paper to be presented at the 2017 Pacific Conference for Development Economics Riverside, California
Henley, David, and Jan Kees Van Donge. 2013. 'Diverging Paths: Explanations and Implications'. In Asian Tigers, African Lions: Comparing the Development Perfomance of SouthEast Asia and Africa. Edited by Berensen Bernard, Ton Dietz, Henk Shulte Nordholt, Roel Van der Veen
Huggins, Chris. 2009. 'Agricultural Policies and Local Grievances in Rural Rwanda'. Peace Review 21 (3): 296–303. https://doi.org/10.1080/10402650903099351.
———. 2012. 'Consolidating Land, Consolidating Control: What Future for Smallholder Farming in Rwanda's 'Green Revolution'?' Land Deal Politics initiative (LPD)
———. 2017. 'Agricultural Reform in Rwanda: Authoritarian, Markets and Zones of Governance'. Zed Books Ltd
IDS. 2015. 'Brokering Development: Enabling Factors for Public-Private-Producer Partnerships in Agricultural Value Chains - Uganda Case Study'. Institute of Development Studies.
IFDC. 2014. 'Rwanda Fertilizer Assessment In Support of The African Fertilizer and Agribusiness Partnership'. IFDC report
IFPRI. 2010. 'What Is the Irrigation Potential in Africa? A Combined Biophysical and Socioeconomic Approach'. Study conducted by IFPRI
ILO. 2002. 'Promotion of Cooperatives Recommendation (No. 193)'. International Labour Organization
———. 2014. 'Cooperatives in Africa: Success and Challenges. A Contribution to the International Symposium on Cooperatives and Sustainable Development Goals'. International Labour Office
IMF. 2011. 'Rwanda : Poverty Reduction Strategy Strategic Paper- Progress Report'. Country Report (Volume 11/154, p.266) Washington D.C. : International Monetory Fund.
IPAR. 2009. 'Rwandan Agricultural Sector Situation Analysis'. PAR Rwanda report
Irz, Xavier, Lin Lin, Colin Thirtle, and Steve Wiggins. 2001. 'Agricultural Productivity Growth and Poverty Alleviation'. Development Policy Review 19 (4): 449–466.
IWMI, and SICWC. 2003. 'How to Establish a Water User's Association? Practical Steps to Social Mobilization'. IWMI

Jayne, Thomas, Caleb Stevens, Sarah Lowery, and Mercedes Stickler. 2016. 'The role of Land Policy in Agricultural Transformation and inclusive economic growth: implications for Africa'. Paper presented at World Bank Conference.
Jayne, Thomas, Jordan Chamberlin, and Derek D. Headey. 2014. 'Land Pressures, the Evolution of Farming Systems, and Development Strategies in Africa: A Synthesis'. Food Policy 48:1–17. https://doi.org/10.1016/j.foodpol.2014.05.014.
Reuben, Jessop, Diallo Boubacar, Duursma Marjan, Mallek Abdallah, Harms Job, and van Manen Bert. 2015. 'Creating Access to Agricultural Finance: Based on a Horizontal Study of Cambodia, Mali, Senegal, Tanzania, Thailand and Tunisia'. World Bank Group
Johnson, Michael, Peter Hazell, and Ashok Gulati. 2003a. 'The Role of Intermediate Factor Markets in Asia's Green Revolution: Lessons for Africa?' American Journal of Agricultural Economics 85 (5): 1211–1216.

Johnston, Bruce F, and John Mellor. 1961. 'The Role of Agriculture in Economic Development'. The American Economic Review 51 (4): 566–593.
Jones, William O. 1987. 'Food-Crop Marketing Boards in Tropical Africa'. The Journal of Modern African Studies 25 (03): 375. https://doi.org/10.1017/S0022278X00009903.
Juma, Calestous. 2011. 'The New Harvest: Agricultural Innovation in Africa'. New York: Oxford University Press.
———. 2016. Innovation and Its Enemies: Why People Resist New Technologies. oxford University Press.
Just, Richard E., and David Zilberman. 1983. 'Stochastic Structure, Farm size and Technology Adoption in Developing Agriculture'. Oxford Economic Papers 35 (2): 307–28.
Kaaria, Susan, Osorio Martha, Wagner Sophie, and Gallina, Ambra. 2016. 'Rural women's participation in producer organizations: An analysis of the barriers that women face and strategies to foster equitable and effective participation'. Journal of Gender, Agriculture and Food Security (Agri-Gender), Africa Centre for Gender, Social Research and Impact Assessment 1(2).
Kaberuka, Will. 1987. 'Uganda's 1946 Colonial Development Plan: An Appraisal'. Transafrican Journal of History 16:185-205
Kagabo, Desire, L Stroosnijder, S Visser, and D Moore. 2013. 'Soil Erosion, Soil Fertility and Crop Yield on Slow-Forming Terraces in the Highlands of Buberuka, Rwanda'. Soil and Tillage Research, 128: 23–29.
Kaliba, Aloyce, Hugo Verkuijl, and Margaret Mwangi. 2000. 'Factors Affecting Adoption of Improved Maize Seeds and Use of Inorganic Fertilizer for Maize Production in the Intermediate and Lowland Zones of Tanzania'. Journal of Agricultural and Applied Economics: 32 (1): 35-47
Karamage, Fidele, Chi Zhang, Felix Kayiranga, Hua Shao, Alphonse Kayinranga, Xia Fang, Lamek Nahayo, Muhire Nyesheja, and Tian Guangjin. 2016. 'Extent of Cropland and Related Soil Erosion Risk in Rwanda'. Sustainability, 8, 609 https://www.mdpi.com/2071-1050/8/7/609/htm.
Karlan, Dean, Beniamino Savonitto, Bram Thuysbaert, and Christopher Udry. 2017. 'Impact of Savings Groups on the Lives of the Poor'. Proceedings of the

National Academy of Sciences 114 (12): 3079–84. https://doi.org/10.1073/pnas.1611520114.

Kasim, Oluwasinaayomi F., and 'Tunde Agbola. 2017. 'Decentralisation and Local Government Reforms in Africa: Challenges, Opportunities and the Way Forward'. Eastern Africa Social Science Research Review 33 (1): 89–113. https://doi.org/10.1353/eas.2017.0004.

Kathiresan, Arumgam. 2011. 'Strategies for Sustainable Crop Intensification in Rwanda: Shifting Focus from Producing Enough to Producing a Surplus'. Ministry of Agriculture and Animal Resources, Rwanda

Kayizzi-Mugerwa, Steve. 1998. 'Africa and the Donor Community: From Conditionality to Partnership'. Journal of International Development 10 (2): 219–25. https://doi.org/10.1002/(SICI)1099-1328(199803/04)10:2<219::AID-JID525>3.0.CO;2-W.

Keeler, Murray, and Dimitrios Skuras. 1990. 'Land Fragmentation and Consolidation Policies in Greek Agriculture'. Geographical Assocoation 75 (1):73-76. http://www.jstor.org/stable/40571937.

Kelly, Valerie, Edson Mpyisi, Anastase Murekezi, and David Neven. 2001. 'Fertilizer Consumption in Rwanda: Past Trends, Future Potential, and Determinants'. Paper prepared for the Policy Workshop on Fertilizer Use and Marketing, organized by MINAGRI and USAID, Rwanda

Kelly, Valerie, and Anastase Murekezi. 2000. 'Fertilizer Response and Profitability in Rwanda'. A Synthesis of Findings from MINAGRI Studies Conducted by the Food Security Research Project (FSRP) and The FAO Soil Fertility Initiative.

Kemper, E, S Stringfields, and C Teddlie. 2003. 'Mixed Methods Sampling Strategies in Social Science Research'. In A. Tashakkori & C. Teddlie (Eds.), Handbook of Mixed Methods in Social and Behavioral Research (Pp. 273-296). Thousand Oaks, CA: Sage.

Kherallah, Mylene, Christopher Delgado, Eleni Gabre-Madhin, Nicholas Minot, and Michael Johnson. 2002. 'Reforming Agricultural Markets in Africa'. Food Policy Statement, Number 38

Kikulwe, Enoch, Fischer Elisabeth, and Martin Qaim. 2014. 'Mobile Money, Smallholder Farmers, and Household Welfare in Kenya'. PloS One

Kim, Sung Kyu. 2017. 'Agricultural Intensification and Smallholder Crop-Livestock Integration in Rwanda'. PhD Thesis.

Kimenyi, Mwangi, Brandon Routman, and Andrew Westbury. 2012. 'CAADP at 10: Progress Toward Agricultural Prosperity'. Https://Www.Brookings.Edu/Wp-Content/Uploads/2016/06/12-CAADP.Pdf

Kinzer, Stephen. 2008. 'A Thousand Hills: Rwanda's Rebirth and the Man Who Dreamt It'. John Wiley & sons Inc. New Jersey

Kiptot, Evelyne, and Steven Franzel. 2015. 'Farmer-to-Farmer Extension: Opportunities for Enhancing Performance of Volunteer Farmer Trainers in Kenya'. Development in Practice 25 (4): 503–17. https://doi.org/10.1080/09614524.2015.1029438.

Kirsten Johann, Andrew Dorward, Colin Poulton, and Nick Vink. 2009. 'Institutional Economic Perceptive on Africa Agricultural Development'. International Food Policy research institute.

Lanteri, Sergio, and Luciana Quagliotti. 1997. 'Problems Related to Seed Production in the African Region'. Euphytica 96(1) 173-183

Larson, Bruce, and George Frisvold. 1996. 'Fertilizers to Support Agricultural Development in Sub-Saharan Africa: What Is Needed and Why'. Food Policy 21(6) 509-525

Lawrence, Barbara. 1984. 'Historical Perspective: Using the Past to Study the Present'. The Academy of Management Review 9 (2): 304–312.

Lele, Uma and Manmohan Agarwal. 1989. 'Smallholder and Large-Scale Agriculture in Africa: Are There Tradeoffs between Growth and Equity?'MADIA Discussion Paper 6. Washington, D.C: World Bank.

Lemarchand, Rene. 1966. 'Power and Stratification in Rwanda: A Reconsideration'. Annee 24 Pg 592-610.

Leurquin, Philippe. 1963. 'Agricultural Change in Ruanda-Urundi 1945-1960' Food Research Institute Studies 4: 39:89," 89, 4 (39).

Lewis, W. 1954. 'Economic Development with Unlimited Supplies of Labour." The Manchester School 22(1): 139-191.

Lichtenstein, Jane. 2017. 'Financial Inclusion in Rwanda: Examining Policy Implementation and Impact on Community and Household Lives'. PhD Thesis University of Cambridge

Linden, Iran. 1975. 'The White Mission in Rwanda'. PhD Thesis University of London.

Lipton, Micheal. 2009. 'Land Reform in Developing Countries: Property Rights and Property Wrongs'. Routlege.

Loevinsohn, Micheal, Johnson Mugarura, and Augustine Nkusi. 1993. 'Cooperation and innovation by farmer groups: Scale in the development of Rwandan valley farming systems'. Applied Ecology Consultants, B.P. 259, Butare, Rwanda.

Long, Scott, and Jeremy Freese. 2001. 'Regression Models for Categorical Dependent Variable Using Stata'. Stata Cooperation.

Louwaars, Niels P. Walter S. de Boef, and Janet Edeme. 2013. 'Integrated Seed Sector Development in Africa: A Basis for Seed Policy and Law'. Journal of Crop Improvement 27 (2): 186–214. https://doi.org/10.1080/15427528.2012.751472.

Lukuyu, B. F. Place, S. Franzel, and E. Kiptot. 2012. 'Disseminating Improved Practices: Are Volunteer Farmer Trainers Effective?' Agricultural Education and Extension 18 (5): 525–40.

LWH. 2015. 'Land Husbandry, Water Harvesting and Hillside Irrigation Project LWH Implementation'. Progress Report."

———. 2017. 'Report on Production Data for Season B 2017'. Project Results Framework.

Mabaya, Edward. 2016. 'Performance of the Formal Seed Sector in Africa: Findings from the African Seed Access Index'. paper presented at the 5th International Conference of the African Association of Agricultural Economists, September 23-26, 2016, Addis Ababa, Ethiopia

Mamdani, Mahmood. 2001. 'When Victims Become Killers: Colonial, Nativism and the Genocide in Rwanda'. Princeton University Press

Masuki, Kenneth Francis, Joy Tukahirwa, Rick Kamugisha, Jeremias Mowo, Joseph Tanui, and Jephine Mogoi. 2007. 'Mobile Phones in Agricultural Information Delivery for Rural Development in Eastern Africa: Lessons from Western Uganda'. http://apps.worldagroforestry.org/downloads/Publications/PDFS/MM10320.pdf

Matuschke, Ira, and Matin Qaim. 2009. 'The Impact of Social Networks on Hybrid Seed Adoption in India'. International Association of Agricultural Economics 40 (5) 493–505.

Maxwell, Joseph, and D. Loomis. 2003. 'Mixed Method Design: An Alternative Approach'. Handbook of Mixed Methods in Social and Behavioral Research, January, 241–72.

May, John. 1995. 'Policies on Population, Land Use, and Environment in Rwanda'. Population and Environment: 6:321–334

McKay, Andrew and Loveridge, Scott, 2005. 'Exploring The Paradox Of Rwandan Agricultural Household Income And Nutritional Outcomes In 1990 And 2000'. Staff Paper Series 11582, Michigan State University, Department of Agricultural, Food, and Resource Economics.

Meinzen-Dick, Ruth, K.V Raju, and Ashok Gulati. 2002. 'What Affects Organization and Collective Action for Managing Resources? Evidence from Canal Irrigation Systems in India'. World Development 30 (4): 649–66. https://doi.org/10.1016/S0305-750X(01)00130-9.

Mellor, John W. 1973. 'Accelerated Growth in Agricultural Production and the Intersectoral Transfer of Resources'. Economic Development and Cultural Change 22 (1): 1–16.

Mellor, John, and Ranade Chandrashekhar. 2006. 'Why Does Agricultural Growth Dominate Poverty Reduction in Low- and Middle-Income Countries?' Pakistan Development Review 45 (2): 221–40.

Meyer, Richard L. 2011. 'Subsidies as an Instrument in Agriculture Finance: A Review'. Joint Discussion Paper, World Bank

Migdal, Joel. 2001. 'State in Society: Studying How States and Societies Transform and Constitute One Another'. Cambridge University Press. doi:10.1017/CBO9780511613067

Miles, Matthew B., A. Michael Huberman, Michael A. 'Huberman, and Prof Michael Huberman. 1994. Qualitative Data Analysis: An Expanded Sourcebook'. Sage Publications, Inc.

MINAGRI. 2007. 'Annual Report 2007'. Ministry of Agriculture and Animal resources

———. 2008. 'Annual Report 2008'. Ministry of Agriculture and Animal resources

———. 2009. 'Strategic Plan for the Transformation of Agriculture in Rwanda – Phase II (PSTA II)'. Ministry of Agriculture and Animal resources

———. 2009a. 'Annual Report 2009'. Ministry of Agriculture Anual Report.

———. 2010a. 'Annual Report 2009-2010'. Ministry of Agriculture and Animal resources'.

———. 2010b. 'Agriculture Gender Strategy Developed in 2010'. Ministry of Agriculture and Animal Resources

———. 2011. 'National Post-Harvest Staple Crop Strategy'. Ministry of Agriculture and Animal Resources Rwanda

———. 2012. 'Annual Report FY 2011/2012'. Ministry of Agriculture and Animal Resources, Rwanda.

———. 2013. 'Annual Report FY 2013/2014' Ministry of Agriculture and Animal Resources, Rwanda.

———. 2015a. 'Annual Report'. FY 2014/2015'. Ministry of Agriculture and Animal Resources

———. 2014b. 'Public Expenditure Review (MINI-PER) in the Agriculture Sector'. Ministry of Agriculture and Animal Resources: Annual Report
———. 2015. 'National Fertilizer Policy'. Ministry of Agriculture and Animal Resources Rwanda
———. 2018. 'Strategic Plan for Agricultural Transformation 2018-2024'. Ministry of Agriculture and Animal Resources Rwanda
MINALOC. 2001. 'National Decentralization Policy'. Republic of Rwanda Ministry of Local Government & Social affairs
——. 2014. ' MINICOM Annual Report 2013/2014'. Ministry of Trade and Industry
——. 2013. 'MINICOM Annual Report 2012/2013'. Ministry of Trade and Industry
———. 2015. 'Annual Report 2014/2015'. Ministry of Trade and Industry
Mittal, Surabhi. 2016. 'Role of Mobile Phone-Enabled Climate Information Services in Gender-Inclusive Agriculture'.Gender, Technology and Development 20 (2): 200–217. https://doi.org/10.1177/0971852416639772.
Mockshell, Jonathan, and Regina Birner. 2015. 'Donors and Domestic Policy Makers: Two Worlds in Agricultural Policy-Making?' Food Policy 55 (August): 1–14. https://doi.org/10.1016/j.foodpol.2015.05.004.
Mohamed, Khahid, and Andrew Temu Andrew. 2008. 'Access to Credit and Its Effect on the Adoption of Agricultural Technologies: The Case of Zanzibar'. African Review of Money Finance and Banking: Pp. 45-89.
Moronha Raymond. 1985. 'The Review of Literature on Land Tenure Systems in Sub- Saharan Africa'. World Bank.
Morris, Michael, Valerie A. Kelly, Ron J. Kopicki, and Derek Byerlee. 2007. 'Fertilizer Use in African Agriculture: Lessons Learned and Good Practice Guidelines'. The World Bank. http://elibrary.worldbank.org/doi/book/10.1596/978-0-8213-6880-0.
Muchara, Binganidzo, Gerald Ortmann, Edilegnaw Wale, and Maxwell Mudhara. 2014. 'Collective Action and Participation in Irrigation Water Management: A Case Study of Mooi River Irrigation Scheme in KwaZulu-Natal Province, South Africa'. Water S.A 40 (October): 699–708. https://doi.org/10.4314/wsa.v40i4.15.
Mukana, Nicholas. 2009. 'Peasant Response to Agricultural Innovations: Land Consolidation, Agrarian Diversification and Technical Change: The Case of Bungoma District in Western Kenya, 1954-1960'. Ufahamu J. Afr. Stud. 35 (1).
Munyambonera, Ezra, Dorothy Nampewo, Annet Adong, and Musa Mayanja. 2012. 'Access and Use of Credit in Uganda: Unlocking the Dilemma of Financing Small Holder Farmers'. Policy Brief, Global Development Network no. 25: (4).
Murindahabi, Theodore, Qiang Li, and E Ekanayake. 2018. 'Economic Analysis of Growth Performance of Various Grains Crops During Agricultural Reform in Rwanda'. Journal of Economics and Sustainable Development 9: (2).
Mwangi, Margaret, and Samweil Kariuki. 2015. 'Factors Determining Adoption of New Agricultural Technology by Smallholder Farmers in Developing Countries'. Economics and Sustainable Development 6(5)
Nahayo, Alphonse, Morris O. Omondi, Xu-hui Zhang, Lian-qing Li, Gen-xing Pan, and Stephen Joseph. 2017. 'Factors Influencing Farmers' Participation in Crop Intensification Program in Rwanda'. Journal of Integrative Agriculture 16 (6): 1406–1416. https://doi.org/10.1016/S2095-3119(16)61555-1.

Narrod, Clare, Devesh Roy, Julius Okello, Belem Avendaño, Karl Rich, and Amit Thorat. 2009. 'Public–Private Partnerships and Collective Action in High Value Fruit and Vegetable Supply Chains'. Food Policy 34 (1): 8–15. https://doi.org/10.1016/j.foodpol.2008.10.005.

Ndamani, Francis, and Tsunemi Watanabe. 2015. 'Influences of Rainfall on Crop Production and Suggestions for Adaptation'. International Journal of Agricultural Sciences 5 (1): 367-374

Ndayizeye, Roose. 1997. 'Agroforestry, water and soil fertility management to fight erosion in tropical mountains of Rwanda'. Soil Technology 11(1)109-119

NEPAD. 2003. 'Comprehensive Africa Agriculture Development Programme'. New Partnership for Africa's Development (NEPAD)

———. 2011. 'The Abuja Declaration on Fertilizers for an African Green Revolution - Status of Implementation at Regional and National'. Comprehensive Africa Agriculture Development Programme (CAADP)

Newbury, Catherine. 1978. 'Ethnicity in Rwanda: A Case of Kinyaga'. Journal of the International African Institute 48 (1) 17-29

Ngoga, Thierry. 2018. 'Rwanda's Land Tenure Reform: Non-Existent to Best Practice'. CAB International

Nilsson, Pia. 2018. 'The Role of Land Use Consolidation in Improving Crop Yields among Farm Households in Rwanda'. The Journal of Development Studies https://doi.org/10.1080/00220388.2018.1520217.

Ninan, K. 1984. 'Labour Use in Agriculture: Case Study of Topioca and Paddy Economic and Political Weekly 19, (51/52) : A199-A204

National Institute of Statistics of Rwanda. 2006. 'Preliminary Poverty Update Report Integrated Living Conditions'.

———. 2014. 'Rwanda Poverty Profile Report 2013/2014, Results of Integrated Household Survey Very Conditions'.

———. 2015a.Gatsibo District Profile: Population and Housing Census 2012'.

———. 2015b.Musanze District Profile: Population and Housing Census 2012'.

———. 2015c. 'Nyamagabe District Profile: Population and Housing Census 2012'.

———. 2015d. 'Nyanza District Profile: Population and Housing Census 2012'.

———. 2016. 'GDP National Accounts 2016'.

———. 2017. 'Agricultural Household Survey 2017'

———. 2018a. 'Rwanda Statistical Year Book'.

———. 2018b. 'The Fifth Integrated Household Living Conditions Survey EICV5 2017/2018'.

Nomathemba, Mhlanga. 2010. 'Factors Affecting Private Sector Involvement in Agriculture. In Private Sector Investment in Sub Saharan Africa'.

Nsanzabaganwa, Monique. 2012. 'Uncertainty and Private Sector Response to Economic Development Policy in Post-Genocide Rwanda'. PhD Thesis Stellenbosch: University. https://scholar.sun.ac.za/handle/10019.1/71932.

Nyamulinda, Birasi, Claude Bizimana, Theophile Niyonzima, and Herman Musahara. 2014. 'Assessment of the Economic, Social, and Environmental Impacts of the Land Use Consolidation Component of the Crop Intensification Program in Rwanda'. Land Project, University of Rwanda Report

Nyanjom, Othieno. 2013. 'The Politics of Policy for Poverty Reduction: Comparing Malaysia and Kenya'. In Bernard Berendsen Ton Dietz, Henk Schulte Nordholt and Roel van der Veen Asian (ed). Tigers and African Lions: Comparing the Development Performance of Southeast Asia and Africa. Edited.

Nyumba, Tobias, Kerrie Wilson, Christina Derrick, and Nibedita Mukherjee. 2017. 'The Use of Focus Group Discussion Methodology: Insights from Two Decades of Application in Conservation. Qualitative Methods for Eliciting Judgments for Decision Making'. Methods Ecol Evol. 2018;9:20–32

Ochepo Adikwu James. 2014. 'Household Size and Agricultural Land-Use Pattern in Obagaji Area of the Guinea Savanna Region, Nigeria'. Journal of Agricultural Extension and Rural Development 6 (1): 48–54. https://doi.org/10.5897/JAERD12.123.

Ochieng, Justus, Beatrice Knerr, George Owuor, and Emily Ouma. 2016. 'Commercialisation of Food Crops and Farm Productivity: Evidence from Smallholders in Central Africa Agricultural Economics Research, Policy in Southern Africa 55(4)

Okito, Maurice 2019. 'Rwanda poverty debate: summarising the debate and estimating consistent historical trends'. Review of Africa Political economy https://www.tandfonline.com/doi/abs/10.1080/03056244.2019.1678463?journalCode=crea20

Okosa, Nomsey, Chukwunonso S. Ekesiobi, Chibuike R. Oguanobi, and Ogonna E. Ifebi. 2017. 'Economics of Food Security in Sub-Saharan Africa:Implication for Sustainable Development'. ANSU Journal of Arts and Social Sciences 5 (2): 1-26.

Olson, Jennifer. 1994. 'Farming Systems in Rwanda: Echoes of Historical Division Reflected in Current Land Use'. Rwanda Society environmental project: Working paper 2

Olson, Jennifer. 1995. 'Behind the Recent Tragedy in Rwanda'. GeoJournal 35 (2): 217–22. https://doi.org/10.1007/BF00814068.

Onazi, O.C. 1982. 'Role of the Extension Specialist in the Transfer of Agricultural Technology: The Northern Nigeria Experience'. Agricultural Administration 9 (3): 229–38.

Onwuegbuzie, Anthony J. 2007. 'A Typology of Mixed Methods Sampling Designs in Social Science Research'. The Qualitative Report 12(2)

Ostrom, Elinor. 1990. 'Governing the Commons: The Evolution of Institutions for Collective Action'. Cambridge, UK: Cambridge University Press.

———. 2000. 'Collective Action and the Evolution of Social Norms'. Journal of Economic Perspectives 14 (3): 137–58.

Otsuka, K, and F Place. 2014. 'Changes in Land Tenure and Agricultural Intensification in Sub-Saharan Africa'. WIDER Working Paper, No. /051

Parayil, Govindan. 992. 'The Green Revolution in India: A Case Study of Technological Change'. Technology and Culture 33 (4): 737.

Payne, Geoffrey. 2008. 'Social and Economic Impact of Land Titling Programs in Urbon and Peri-Urban Areas: Internal Experieinces and Case Study of Senegal and South Africa'. Ministry of Foreign Affairs, Government of Norway: Final report

Pinto, Yvonne, Colin Poulton, Tim Frankenberger, and Olu Ajayi. 2014. 'Drivers of Success Synthesis Report Caadp. CAADP Report

Pimentel, David, and Marcia Pimentel. 1990. ‘Comment: Adverse Environmental Consequences of the Green Revolution’. Population and Development Review 16: 329. https://doi.org/10.2307/2808081

Platteau, Jean-Philippe.1996. 'Physical infrastructure as a constraint on agricultural growth: The case of Sub Saharan Africa'. Oxford Development Studies, 24(3): 189-219.

Poole, Nigel. 2017. 'Smallholder Agriculture and Market Participation. Practical Action Publishing'. eBook https://doi.org/10.3362/9781780449401.

Poulton, Colin, Jonathan Kydd, and Andrew Dorward. 2006a. 'Increasing Fertilizer Use in Africa: What Have We Learned?' Agriculture and Rural Development Department, World Bank

———. 2006b. 'Overcoming Market Constraints on Pro-Poor Agricultural Growth in Sub-Saharan Africa'. Development Policy Review, 2006, 24 (3): 243-277

Poulton, Colin, and Jon Macartney. 2012. 'Can Public–Private Partnerships Leverage Private Investment in Agricultural Value Chains in Africa? A Preliminary Review'. World Development 40 (1): 96–109. https://doi.org/10.1016/j.worlddev.2011.05.017.

Pritchard, Matthew F. 2013. 'Land, Power and Peace: Tenure Formalization, Agricultural Reform, and Livelihood Insecurity in Rural Rwanda'. Land Use Policy 30 (1): 186–96. https://doi.org/10.1016/j.landusepol.2012.03.012.

Punch, F. 2005. 'Introduction To Social Research: Quantitative and Qualitative Approaches'. Sage Publications London

Rahman, Atiqur, and Jennefer Smolak. 2014. 'Financing Smallholder Farmers in Developing Countries'. In Hazell Peter and Rahman Atiqur New Direction for Smallholder Agriculture. 1st ed. IFAD.

Ramirez, Ana. 2013. 'The Influence of Social Networks on Agricultural Technology Adoption'. Procedia - Social and Behavioral Sciences 79 (6):101–16.

Randall, Baker 1970. 'Reorientation in Rwanda. African Affairs'. 69 (275): 141-154.

Reardon, Thomas, C. Peter Timmer, and Julio Berdegué. 2008. 'The Rapid Rise of Supermarkets in Developing Countries: Induced Organisational, Institutional and Technological Change in Agri-Food System'. In The Transformation of Agri-Food Systems: Globalisation, Supply, and Smallholder Farmers. FAO.

RGB. 2018. 'Good Governance and Decentralization in Rwanda'. Rwanda Governance Review 2018

Rhealt, Magali, and Justin Mcarthy. 2015. 'Disparities in Cellphone Ownership Pose Challenges in Africa'. Gallup World Poll, February 17, 2015.

Roberts. 2009.'The Role of Fertilizers in Growing the World Food'. Better Crops 93 (2)

Rogers, Everett M. 1983. 'Diffusion of Innovations'. 3rd ed. New York : London. Free Press.

RSSP. 2008. 'Rural Sector Support Project Document'. World Bank

———. 2014. 'Rural Sector Support Project 2 Aide Memoir" World Bank Report.”

———. 2015. “Progress Report 2015'. Rural Sector Support Project

Thurow, Roger 2013. 'The Last Hunger Season: A Year in an African Farm Community on the Brink of Change'. World Food program 1 https://www.wfpusa.org/stories/what-the-hunger-season-means-for-farmers-fighting-famine/#

Saini, G. 1971. 'Holding Size, Productivity and Some Related Aspects of Indian Agriculture'. Economic and Political Weekly'. Review of Agriculture 6(26): 79 – 85.
Sebastian, K. 2008. 'Gis/Spartial Analysis , Contribution to 2008 Market Access Data WDR'. Background Paper for the World Development Report 2008.
Segal, Aaron. 1964. 'Rwanda/ the Underlying Causes: A behind -the headlines Report on Bahutu-Batutsi Warfare.' Africa-America Institute
Scott, James. 1998. 'Seeing like a State: Certain Schemes to Improve the Human Condition Have Failed'. Yale University
Sidebottom, Richard 2016. 'How do market actors manage the 'rules of the game' in the Cotton Textiles & Apparel sector?' Thesis submitted for the degree of Doctor of Philosophy
Singh, Inderjit. 1990. 'The Great Ascent. The Rural Poor in South Asia'. Johns Hopkins University Press.
Sitko, Nicholas J, Jordan Chamberlin, and Munguzwe Hichaambwa. 2014. 'Does Smallholder Land Titling Facilitate Agricultural Growth?: An Analysis of the Determinants and Effects of Smallholder Land Titling in Zambia'. World Development 64: 791–802. https://doi.org/10.1016/j.worlddev.2014.07.014.
Slicher Van Bath, H. 1969. 'Eighteenth-Century Agriculture on the Continent of Europe'. Agricultural History 43 (1): 169-180.
Starr, Arthur J. 1941. '18th Century Agriculture in Suffolk'. Geography 26 (3): 116–125.
Suruma, Ezra. 2014. 'Improving Africa's Agricultural Infrastructure : In Advancing the Ugandan Economy: A personal account'. https://www.jstor.org/stable/10.7864/j.ctt6wpcfb.19.
Swai, Sophia Faustin. 2016. 'The Impact Of Land Size And Farm Fragmentation On Household Welfare'. The Case Of Kilosa District In Morogoro, Tanzania. PhD Thesis
Swaminathan, MS. 1992. 'Agricultural Production in Africa'. In Challenges of Agricultural Production and Food Security in Africa Edited by Olusegun Obsanjo and Hans d'Orville Washington: Taylor and Francis Inc.
Thorbecke, Erik. 1980. 'Agriculture and Economic Development'. Social Research 47 (2) 290-304. http://www.jstor.org/stable/40982646.
Timmer, Peter. 1969. 'The Turnip, The New Husbandry, and The English Agricultural Revolution'. The Quarterly Journal of Economics 83 (3): 375. https://doi.org/10.2307/1880527.
———. 1991. 'Agriculture and Economic Development Revisited'. Agricultural Systems 40 (1-3): 21-58.
———. 2005. 'Agriculture and Pro-Poor Growth: An Asian Perspective-working paper 63'. Centre for Global Development
Torero, Maximo. 2014. 'Targeting Investments to Link Farmers to Markets: A Framework for Capturing Heterogeinity of Smallholder Farmers'. In Peter Hazell and Atiqur Rahman (Ed). New Direction for Smallholder Agriculture.
Trenberth, Kevin. 2011. 'Changes in Precipitation with Climate Change'. Climate Research 47 (1): 123–38. https://doi.org/10.3354/cr00953.
Udomkun, Patchimaporn, Tesfamicheal Wossen, Nsharwasi L. Nabahungu, Charity Mutegi, Bernard Vanlauwe, and Ranajit Bandyopadhyay. 2018. 'Incidence and Farmers' Knowledge of Aflatoxin Contamination and Control in Eastern

Democratic Republic of Congo'. Food Science & Nutrition 6 (6): 1607–20. https://doi.org/10.1002/fsn3.735.
Udry, Christopher. 2019. 'Information, Market Access and Risk: Addressing Constraints to Agricultural Transformation in Northern Ghana'. Report on Disseminating Innovative Resource-Based Technologies for Small Scale Farmers in Ghana
UNDP. 2008. 'Assessment of Development Results Evaluation of UNDP Contribution in Rwanda'. UNDP report
United Nations. 2015. 'Millennium Development Goals Report: Lessons Learnt in the Development of the MDGs'. United Nations
USAID. 2009. 'Childhood Mortality in Rwanda: Levels, Trends, and Differentials Further Analysis of the Rwanda Demographic and Health Surveys Report 1992-2007/08'.
———. 2012. 'The Business Case for Investing in the Import and Distribution of Fertilizer in Rwanda' Study.
Van den Broek, and Jean Marie Byakweli. 2014. 'Exploratory Study on Rwanda's Seed Sector: Options for Dutch Support'. Centre for Development Innovation, Wangeningen
Vansina 1979 'Finding Food and the History of Pre-colonial Equatorial Africa: A Plea" African Economic History, 7: 9-20 https://www.jstor.org/stable/3601199
Verdoodt, A, and E Van Ranst. 2003. 'Land Evaluation for Agricultural Production in the Tropics. A Large-Scale Land Suitability Classification for Rwanda'. laboratory of Soil Science, Ghent University, Gent
Verwimp, Philip. 2002. 'Agricultural Policy, Crop Failure and the 'Ruriganiza' Famine (1989) in Southern Rwanda' A Prelude to Genocide?" Discussion paper series: Department of Economics Leuven
Verwimp, Philip. 2000. "Development ideology, the peasantry and genocide: Rwanda represented in Habyarimana's speeches," Journal of Genocide Research 2 (3) 325–361.
———. 2004. 'Peasant Ideology and Genocide in Rwanda Under Habyarimana' Https://Www.Files.Ethz.Ch/Isn/92171/GS19.Pdf. https://www.files.ethz.ch/isn/92171/GS19.pdf.
Von Braun, Joachin, Hartwig De Haen, and Juergen Blanken. 1991. 'Commercialisation of Agriculture under Population Pressure: Effects on Production, Consumption, and Nutrition in Rwanda'. Research Report 85. International Food Policy Research Institute (IFPRI).
Vorley, Bill. 2002. 'Sustaining Agriculture: Policy, Governance, and the Future of Family- Based Farming'. A synthesis Report of the Collaborative Research Project Policies that work for Sustainable Agriculture and Regenerating Rural Livelihoods.
Williams, D. M. 1953. 'West African Marketing Boards'. African Affairs 52 (206): 45–54. https://doi.org/10.1093/oxfordjournals.afraf.a094113.

Whitfield, Lindsay, and Alastair Fraser. 2010. 'Negotiating Aid: The Structural Conditions Shaping the Negotiating Strategies of African Governments'. International Negotiation 15 (3): 341–66. https://doi.org/10.1163/157180610X529582.
World Development Report, 1992. 'Development and the Environment'.

———. 2008. Agriculture for Development. World Bank Washington D.C
World Food Program. 2015. 'Rwanda Comprehensive Food Security and Vulnerability Analysis'.Government of Rwanda.
World Bank. 1981. 'Accelerate Development in Sub Saharan Africa: An Agenda for Action'. The World Bank
———. 1991. 'Rwanda Agriculture Strategy Review'. Washington, D.C: World Bank
———. 2004. 'Poverty Reduction Strategy Initiative: An Independent Evaluation of the World Bank's Support through 2003'.
———. 2011a. 'Missing Food: The Case of Post-Harvest Losses in South Saharan Africa'. World Bank. http://siteresources.worldbank.org/INTARD/Resources/MissingFoods10_web.pdf.
———. 2011b. 'Rwanda Economic Update: Seeds for High Growth'. The World Bank
———. 2013. 'Rwanda Economic Update. Maintaining Momentum: With Special Focus on Rwanda's Pathway out of Poverty'. The World Bank
———. 2014. 'Republic of Rwanda Agricultural Policy Note, Promoting Agricultural Growth in Rwanda; Recent Opportunities, Challenges and Opportunities'. The World Bank
———. 2015. 'Rwanda Achieving Agricultural Transformation and Leading the Way Http://Www.Worldbank.Org/En/News/Feature/2015/06/09/Achieving-Agricultural-Transformation-Rwanda-Leads-the-Way."
———.2016 'World Bank. 2016'. 'World Bank (2016) Rwanda Economic Update: Rwanda at Work'.
World Health Organisation. 2014. "World Malaria Report' WHO.
Woo-Cummings, Meredith (ed) (1999). The Developmental State'. London, Cornell University Press.
You, Liangzhi, Claudia Ringler, Ulrike Wood-Sichra, Richard Robertson, Stanley Wood, Tingju Zhu, Gerald Nelson, Zhe Guo, and Yan Sun. 2011. "What Is the Irrigation Potential for Africa? A Combined Biophysical and Socioeconomic Approach." Food Policy 36 (6): 770–82. https://doi.org/10.1016/j.foodpol.2011.09.001.
Zeleza, Tiyambe. 1989. 'The Global Dimensions of Africa's Crisis: Debts, Structural Adjustment and Workers' Transafrican Journal of History 18: 1–53.
Zimmermann, Roukayatou, Michael Bruntrüp, Shashidhara Kolavalli, and Kathleen Flaherty. 2009. 'Agricultural Policies in Sub –Saharan Africa: Understanding CAADP and APRM Policy Process'. Research report, Studies, Deutsches Institut für Entwicklungspolitik (DIE)

Appendices

11.2 Appendix II: In-Depth 'Elite' Interviews

Open-ended questions for policymakers and private sector

1. How do you compare agriculture today with agriculture 15 years ago?
2. How are agricultural policies formulated, implemented and monitored?
3. To what extent has government policies been effective in generating agricultural growth?
4. What key factors have been important in supporting increased yield and commercialisation among farmers?
5. What key roles have different institutions (government, farmers, donors and private sector) played in stimulating and sustaining this agriculture? What did these institutions do differently to induce growth?
6. What would be highlighted as the main achievements and difficulties encountered in the process of agriculture development?
7. In hindsight what key lessons have been learnt in the process of agricultural development?
8. What policies have been most significant in promoting agriculture growth and why?
9. How has this growth in agriculture been significant in the development process?
10. What motivates you?

11.3 Appendix III: Open-Ended Questions for Group Discussions

1. How do you compare agriculture today with agriculture 15 years ago?
2. What key factors have been important in supporting increased yield and commercialisation among for you?
3. What would be highlighted as the main achievements and difficulties encountered in the process of agriculture development?
4. In hindsight what key lessons have been learnt in the process of agricultural development?
5. What has been most significant in promoting agriculture growth in your village and why?

11.4 Appendix IV: Farmers' Survey Questionnaire

These questions will be exclusively for farmers in rural Rwanda. The survey questionnaire contains both closed and open-ended questions.

Questionnaire code: ____________

Date: ______________________________

Name: ______________________________

Section 1: Household Identification

1.1 Household location

1	Name of Province	
2	Name of District	
3	Name of Sector	
4	Name of Cell	
5	Name of Village	
6	Distance of the household from main road	
7	Distance of household from main market	
8	Distance of household from the Sacco	
9	Distance of household from a trading centre	
10	Distance of household from a agro processing	
11	Distance from the sector office	
12	Distance from the district office	
13	Distance of your from the furthest plot	
14	Distance to your nearest plot	

1.2 Identification of respondent

1	Farmers name (respondent)	
2	Gender	1 = Male 2 = Female
3	Age (years)	
4	Marital status	1 = Married 2 = Single 3 = Divorced 4 = Separated 5 = Widowed 6= others
5	Relationship to the head of the household	1 = Household Head (HHH) 2 = Spouse of HHH 3 = Son/Daughter of HHH 4 = Adopted/foster/step child of HHH 65 = Father/Mother of HHH 6 = Brother/Sister of HHH 7 = Grandchild of HHH 8 = Other relationship to HHH 9 = No relationship to the HHH 10 = Domestic worker
6	Household size	1= Number of children ___________ 2= Number of adults _________________ 3= Number of extended family ________________

7	Can farmer read a letter or a simple note?	1 = Yes 2 = No
8	Can farmer write a letter or a simple note?	1 = Yes 2 = No
9	Has farmer been to formal school?	1= Yes 2=No
10	Level of education	1 = Primary School 2 = Secondary school 3 = University 4 = adult education 5 = Technical education
11	Main occupation	1= Agriculture own cultivation 2 = Agricultural Labour 3 = Own farm business 4 = Own non-farm business 5 = Casual labour, non-agricultural 6 = Regular wage/salary 7 = VUP Public Works 8 = trader
12	Does farmer own a phone?	1=Yes 2= No
13	How long have they lived in this location?	
14	Where did you live before? Sector and cell	
15	What were the reasons for reallocating to this location?	1= marriage 2= in search for better agricultural land 3= in search for Job opportunities

		4= War genocide 5= I was born here
16	Do you hold a leadership position	1=Yes 2=No
17	Mention the position held	1 = village leader 2 = cooperative leader 3 = others
18	Ubudehe category	

Section 2: General questions on agricultural performance

1. Looking back, how would you compare agriculture today to 15 years ago, (2000)?
2. What partnerships have been important for your agricultural activities?
3. Pleased mention why these partnerships have been important?

Section 3: agricultural production

1. How many plots of land do you own________?
2. How many hectares/ Are of land do you own __________?

Land owned

Sources of land	Size (are)	Location 1= Hillside 2=Valley 3= marshland	When did you acquire this land? (Year)	Size of land used for agricultural production (ha)	Which of the land has a land title? 1= titled 2= No title	What do you use this land for? 1= livestock 2 = renting 3 = rending it 4= agricultural 5 = others	Which of this land is fully utilized every season? 1= fully utilised 2= not fully utilised 3= not utilized
Inherited							
Redistribution							
Bought							
Rented or leased							
Borrowed							
Land left idle							
Others							

3. If land is left Idle, please mention why. 1= land infertile, 2= have limited labour, 3= have limited seed and fertilizers, 4= land has wrangles, 5 = land is difficult to cultivate
4. How has having a land title benefited you? 1= collateral for credit, 2 = encourage long term investment, 3= sense of stability and ownership.
5. Is there any land protected from soil erosion Yes/ No.
6. How much of your land is protected? 1= all agricultural land, 2 = none of the agricultural 3 = others please specify
7. What issues do you have concerning land

3.2 **Type of crops grown**

Season	Crops grown in the last 12 months	Name main crops grown in 2010.	Name main crops grown in 2005.	Name main crops grown in 2000.
Season A				
Season B				
Season C				
Perennial crops				

Note: Season A, August-January; Season B, February- June; Season C June-August

8. If there are crop changes indicated above, please mention reasons for crop changes 1 =

9. How do you decide what to grow every season?
10. Has the crop selection process changed over the last 15 years? 1= Yes, 2 =No
11. Please give reasons for changes in the seasonal crop selection process if any.

12. What changes have observed in season preparation in the last 15 years

3.3 Type of technologies used

Which technologies do you use?	Did you use this technology in the last 12 months?	How did you first hear about the technology?	How did you access the technology?	Who was significant in helping you learn about the new technology?	Main crop to which this technology is applied	Which year did you start using technolog y?	Have you used this technolog y since? 1= No 2=Yes	Which three technologies would you advise them to try first? 1 = most preferred

13. Please highlight why the 3 technologies mentioned in the table below are most preferred.

    1= improves productivity 2 = doesn't require a lot of resources 3 easy access 4 subsidy

14. If no new technologies are used, please give reasons why. 1= not available, 2 = too expensive, 3= not convinced about their use, 4= lack of information

15. If stopped use of a technology, please mention why.

    Technology _____Reason stopped use, 1= not available, 2 = too expensive, 3= labour intensive, 4= time consuming

    Technology _____ Reason stopped use, 1= not available, 2 = too expensive, 3= labour intensive, 4= time consuming

16. Please give your experience in adopting the new seeds and fertilizers.
17. How were you convinced to try out the new technologies?
18. What support was important during adoption and why
19. What changes in technology transfer have you observed?

20. Did you have any challenges in increasing land productivity? 1 = Yes; 2=No

21. How did you sort the issues

    1= Drought ____ solution _______

    2= delayed seed (mention seed) – Solution _______

    3 = delayed fertilizers _____________

    4 = Disease (mention disease

    5 = others

3.4 Agricultural Inputs

Input	Amount used in the last 12 months		Cost on the input		Did the input cost more or less in 2010 compared today	Did the input cost more or less in 2005 compared to today	Did the input cost more or less in 2000 compared to today.
Season	A	B	A	B	Less/more/same/none	Less/more/same/none	Less/more/same/none
Improved seed (kg)					Less/more/same/none	Less/more/same/none	Less/more/same/none
NPK (kg)					Less/more/same/none	Less/more/same/none	Less/more/same/none
DAP (Kg)					Less/more/same/none	Less/more/same/none	Less/more/same/none
Urea (Kg)					Less/more/same/none	Less/more/same/none	Less/more/same/none
Cow manure (baskets 15kgs)					Less/more/same/none	Less/more/same/none	Less/more/same/none
Compost (baskets 15 kgs)					Less/more/same/none	Less/more/same/none	Less/more/same/none
Lime (Kg)					Less/more/same/none	Less/more/same/none	Less/more/same/none
Family labour (Number)					Less/more/same/none	Less/more/same/none	Less/more/same/none
Hired labour (number)					Less/more/same/none	Less/more/same/none	Less/more/same/none
Land management technique (Area)					Less/more/same/none	Less/more/same/none	Less/more/same/none

What is the source of your finances for inputs? 1 = borrowing from friends, 2 = Credit from Sacco, 3 = Bank, 4 = income from previous season sales, 5 = Saving

22. What support have you received to make agricultural inputs affordable? 1 = Government subsidy, 2 = Credit form agro- dealer, 3 = group surety

3.5 Farming methods

	1. Farming method	2. Did use this farming system in the last 12 month? Yes /No	3. If yes, when did you start using these systems? (Year)	4. Do you still use this method for all your agricultural Yes/No	7. If used and stooped	7. If not used at all give reason.	7. Did you use more/less/ same 15 years ago?
1	Early planting						
2	Mono cropping						
3	Line planting						
4	Intercropping						
5	Mulching						
7	Agroforestry						
8	Pest management						
9	Improved seed						
10	Inorganic fertilizers						

Section 4:0 Agricultural output

4.1 Crops planted, input used, and crops harvests the last 12 months

Season	Name type of crops grown in the last 12 months.		Total amount of seed used in the last 12 months	Total amount of NPK used in the last 12 months (Kg)	Total Amount of DAP used in the last 12 months.	Total amount of urea used in the last 12 months (Kg)	Total cost of labour used in the last 12 months (Rwf)	Total amount of harvest (Kg)	Amount sold (kg)	Price (Rwf)
	Crop	Land size (are)								
Season A										
Season B										
Season C										
Perennial crops										

4.2 Crops harvested

Season	On average how much crop did you harvest (per Are) in 2010 compared last year? (are is 10*10m)	How much crop did you harvest per (are) in 2005 compared to last year?	How much crop did you harvest per (are) in 2000 compared to last year? (2000)	If productivity increased give reason	If productivity reduced give reason
A	(*less / more/ same*)	(*less / more/ same*)	(*less / more/ same*)		
B	(*less / more/ same*)	(*less / more/ same*)	(*less / more/ same*)		
C	(*less / more/ same*)	(*less / more/ same*)	(*less / more/ same*)		
Perennial	(*less / more/ same*)	(*less / more/ same*)	(*less / more/ same*)		

1. What year did you achieve the highest harvest (2000-2015)?
2. Please highlight how this high yield was achieved.
3. Do you receive training on how to increase productivity 1 = Yes , 2 = No
4. When does that training take place. 1 = any time; 2= at planting; 3 = at harvest; 4 = when buying inputs; 5= others
5. When do you think is the best time to train farmers how to increase productivity 1 = any time; 2= at planting; 3 = at harvest; 4 = when buying inputs; 5= others

Section 5: Farmers organisations and services

5.1 Farmers associations

Name of Farming organisations	Are you are member?	When did you Join? (Year)	How did you know about the organisation?	What is your role?	Why did you Join	How have you benefited from this organisation	Which of these would you recommend to a friend
Farms association							
Saving group							
Agricultural Cooperative							
Sacco							
Water uses association							

1. Please explain how the preferred organisations work to achieve the mentioned benefit.

Organisation ___ benefit

Organisation ___ benefit

Organisation ___benefit

2. If not in any group above, please mention why.

5.2 Access to services

Services used	Was it easily accessible? Yes/No	Used in 2010 Yes/No	Was it easily accessible? Yes/No	Used in 2005 Yes/No	Was it easily accessible? Yes/No	Used in 2000? Yes/No	Was it easily Accessible Yes/No	How often did you use these services in 2016?	Mention the service that has been most significant for your agricultural activities 1= most preferred to 12
Extension services									
Sacco services									
Bank services									
Credit services									
Cooperative									
Storage facilities									
Study tour									
Demonstration plot									
Collection centre									
Feeder Road									
Agro dealer									

3. Please explain why the 3 services highlighted are most proffered.

Service ____ benefit

Service _____ benefit

Service _______ benefit

4. Have you received any external support for your agricultural activities?

   Yes /no

5. Please specify type of support, period and benefit?

6. What suggestion would you make for type of technologies and services needed for future agricultural improvement for you and your neighbours?

7. Please advise on ways to make agricultural inputs easily accessible to farmers?

Section 6: Agricultural commercialisation

6.1 sources of income

Source of income	Source of income in the last 12 months? (Rwf)	Source of income in 2010? (Rwf)	Source of income in 2005? (Rwf)	Source of income in 2000? (Rwf)
Sale of livestock			More/less/ same	More/same/sa me
Sale of livestock products (eg. Egg, milk, meet)			More/less/ same	More/less/same
Any other own-farm enterprise (like sale/renting agricultural equipment)				
Non-agricultural enterprise (like phone charging)				
Casual labour				
Regular wage/ salaried labour				
VuP Public program				
Gift				
Renting land				
Sale of land				
Remittances (from family/friends and from Government or NGOs in terms of scholarships, grants)				
Interests and dividends				

Sources of household income

1. Which year did you earn the most from agriculture activities? Please state reasons for the high income.
2. Do you have a bank or Sacco account? 1 = yes; 1= No
3. Have you ever saved money? Yes/No
4. When did you start saving?
5. Where do you save?
6. When did you save the most? Please mention how?
7. What do you think could help you save more money?
8. Have you ever received a loan Yes/ No?
9. If yes, name the financial institutions.

10. Which year did you start using the financial institution?

11. Have you used credit for agriculture activities? Yes / No

12. Was it a good or bad experience?

Please explain the answer above.

13. Do you still use financial institutions ? Yes / No

14. What challenges have you faced in working with financial service?

15. What were biggest expenses 2016?

Use of agricultural output

Agricultural output	Season	Amount in the last 12 Months.	Compared to amount in 2010 is this more less or same	Compared to amount in 2005 Is this more less or the same	Compared to amount in 2000 is this more less or the same
Total amount Output harvested (T/ha)	A		More/ less/ same	More/ less/ same	More/ less/ same
	B		More/ less/ same	More/ less/ same	More/ less/ same
Output consumed (T)	A		More/ less/ same	More/ less/ same	More/ less/ same
	B				
Output gifted (T)	A		More/ less/ same	More/ less/ same	More/ less/ same
	B				
Total output Sold (T)	A		More/ less/ same	More/ less/ same	More/ less/ same
	B				
Total income received from sales (Rwf)	A		More/ less/ same	More/ less/ same	More/ less/ same
	B				
Amount invested back in farming (Rwf)	A		More/ less/ same	More/ less/ same	More/ less/ same
Amount invested in non-agriculture					

Markets for farm output

Type of market used	Where did you sell your agric. product in last 12 months	How did you get information about the market?	Type of selling agreements used?	When did you start selling to this market?	Do you sell produce every year? 1= yes 2= No	How do you dry your dry product?	Where do you store your product?	How do you transport your products to the said market?
Neighbours								
Retail market								
Traders								
Farm gate								
Cooperative								
Agro industries								
NGO								
Others								

Note: Type of selling agreement may be contract-farming contract, selling contract at harvest, informal agreement

16.

17. Have you noticed changes in the marketing system since 2000? 1= No 2=Yes

18. Please mention how these changes took place.

19. If you on a phone, how has that benefited your agriculture.

20. How have those changes impacted your agricultural activities?

21. Suggest ways in which agricultural marketing in your farming community can be improved?

Section 7: Impact of agricultural growth on food security and income

1. What role does agriculture play in your household?

Sources of food

Sources of food	Source of food in 2015. *(1 for main source, 2 3….)* 0 if not used	Sources of food 5 years ago. *(1 for main source, 2 3….)* 0 if not used	Sources of food 10 years ago. *(1 for main source, 2 3….)* 0 if not used	Sources of food 15 years ago *(1 for main source, 2 3….)* 0 if not used
Own harvest				
Market				
Gift from friend and family				
Food distribution centres (GoR or NGO)				
Shared harvest				
Others				

22. In the last year, was there a time when your family failed to eat once a day? Yes/No
23. Which year did your family and neighbours last face severe food scarcity?
24. What was the cause of the food scarcity?

Have you observed this in your, home or village?

Incidences	Did you notice any of these in your village 2015?	Was it more, less or same 2005?	Was it more, less or same2010?	Was it more, less or more 2000?
Food scarcity	Yes / No	More /less/ same	More /less/ same	More /less/ same
Food distribution	Yes/ no	More/ less/ same	More/less/same	
High food prices	Yes / No	More /less/ same	More /less/ same	More /less/ same
Hunger	Yes / No	More /less/ same	More /less/ same	More /less/ same
Famine	Yes / No	More /less/ same	More /less/ same	More /less/ same
Migration for search of food	Yes / No	More /less/ same	More /less/ same	More /less/ same
Malnutrition	Yes / No	More /less/ same	More /less/ same	More /less/ same
Child stunting	Yes / No	More /less/ same	More /less/ same	More /less/ same
	Yes / No	More /less/ same	More /less/ same	More /less/ same

Section 7: Household assets

Asset	How many 2016	How many did have in 2010?	How many did you have in 2000? More/Less	How many do you think you will have in five years to come in 2020
1. land		More/ less	More/ less	More/ less
2. House		More/ less	More/ less	More/ less
3. Phone		More/ less	More/ less	More/ less
4. Bicycle		More/ less	More/ less	More/ less
5. Mattress		More/ less	More/ less	More/ less
6. Radio		More/ less	More/ less	More/ less
7. T.V.		More/ less	More/ less	More/ less
8. Goat		More/ less	More/ less	More/ less
9. Cow		More/ less	More/ less	More/ less
10. Other small animals		More/ less	More/ less	More/ less
11. Other assets *(list items)*		More/ less	More/ less	More/ less

25. If you have experienced increased agriculture output what effect has that had in your village and household?

26. If your yields per hectare have increased, what factors have contributed most to that increase

27. If your yield has reduced, please mention key factors contribution the reduction.

28. Looking at the past 15 years, do you regard your life better, worse or same?

29. Looking back, what are the lessons learnt in the process of agricultural development

30. Please suggest what can be done to increase agricultural productivity in your village.