FACTORS AFFECTING TEA CREDIT UTILISATION AND ITS IMPACT ON FARM INCOME IN NYARUGURU DISTRICT, RWANDA

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DECLARATION AND RECOMMENDATION

Declaration

This thesis is my original work and has not been presented in this University or any other for the award of a degree.

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DEDICATION

This work is dedicated to my loving and caring mother of our children, Rosine Ingabire, and our daughters, Nancy Iriza and Janis Ineza, who have been and will always be my comforters and the source of my strength.

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ABSTRACT

The role of agricultural credit is unquestionably a factor in improving farm outputs. In Rwanda, the efforts to lessen barriers for smallholder farmers to accessing credits are clear to improve farmers' professionalisation and farm productivity. Tea production is among value chains selected in the National Agriculture Policy and the Sector Transformation Strategy. In addition, it is significantly contributing to the monetisation of the Country's economy and raised income for households in the rural areas. Since 2012, tea expansion program has contributed to the increased demand for credits by tea farmers. Despite this growth, the sub sector is still challenged by the low production of green tea leaves which affect the production of tea processing factories and the targeted tea exports' volume. Poor tea credits performance is amongst the challenges. The main objective of this study was to contribute to the sustainable management of tea credits by investigating the factors that influencing credit utilisation in tea production areas and its impact on farm income in Rwanda. A survey was conducted on 358 tea growers selected randomly from two cooperatives operating in Nyaruguru District in Southern Province of Rwanda. Three econometric models; Multivariate Probit, Fractional Logit and Endogenous Switching Regression models were used to analyse factors of credit sources selection, credit utilisation and its impact on tea farm income respectively. The results showed that informal sector remained predominant to lend tea farmers with 81% against 31% of the formal sector. Borrowing from formal sources was influenced by the disposable collateral asset (85.5%), interest rate (85.0%), size of owned tea plantation (24.8%), and household composition (10.5%). The utilisation of informal sources increased if farmers needed small credit (83.2%), participating in training on technical production (76.9%) and is they accept to borrow in groups (46.9%). Combining sources of credit was also common (86%) to top up the balance. Utilisation of accessed credits for tea production was influenced by receiving credit in groups (p<0.01), training on tea production and credit management (p<0.01), production costs (p<0.01) and credit from informal sources (p<0.01). Off-farm businesses (p<0.01) and larger credit amount (p<0.01) both increased incidences of credit diversion. The causal effect of credit was a 7% increase in tea income for farmers who utilised credit for tea, while its potential effect was up to a 55% decrease in income for those who diverted credits. Framers' cooperatives have a positive on credits performance when they are involved in lending and credit management. Credits in form of inputs and procuring farm inputs in bulk should be vigorously pursued to discourage credit diversion. Finally, there is need of policy actions that harmonise financial interventions and integration of other socio-economic attributes that have real-valued utilities for households to sustain living needs.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

AFR	:	Access to Finance Rwanda
ATM	:	Automatic Teller Machines
BDF	:	Business Development Fund
COOTHEMUKI	:	Cooperative des Theiculteurs de Muganza-Kivu
COTHENK	:	Cooperative des Théiculteurs Nshili –Kivu
CTC	:	Cu, Tear, Curl
CUI	:	Credit Utilisation Index
DBR	:	Development Bank of Rwanda
ECIV5	:	Integrated Household Living Survey
EDPRS	:	Economic Development and Poverty Reduction Strategy
ESR	:	Endogenous Switching Regression
FAO	:	Food and Agriculture Organisation
FERWACOTHE	:	Fédération Rwandaise des Coopératives du Théiculteurs
FIML	:	Full Information Maximum Likelihood
FLM	:	Fractional Logit Model
FRW	:	Franc Rwandais "Rwandan Francs"
GAP	:	Good Agricultural Practices
GDP	:	Gross Domestic Product
IFAD	:	International Fund for Agricultural Development
IPAR	:	Institute of Policy Analysis and Research
ITC	:	International Tea Committee
MFIs	:	Microfinance Institutions
MINAGRI	:	Ministry of Agriculture and Animal Resources
MINECOFIN	:	Ministry of Finance and Economic Planning
MINICOM	:	Ministry of Trade and Industry
MoMo	:	Mobile Money
MT	:	Metric Tons
MVP	:	Multivariate Probit
NAEB	:	National Agricultural Export Development Board
NAP	:	National Agriculture Policy
NBR	:	National Bank of Rwanda
NFIS	:	National Financial Inclusion Strategy

NISR	**:**	National Institute of Statistics of Rwanda
NLS	:	Non-Linear Squares
NPLs	**:**	Non-Performance Loans
NST1	:	National Strategies for Transformation 2018-2024
PSTA	:	Strategic Plan for Agricultural Transformation
QML	**:**	Quasi-Maximum Likelihood Method
RNRA	**:**	Rwanda Natural Resources Authority
ROSCA	**:**	Rotating Credit and Savings Association
RUT	:	Random Utility Theory
RUT	**:**	Random Utility Theory
SACCOs	**:**	Saving and Credit Cooperative Organisations
SLLTC	:	Simple Loose-Leaf Tea Company
SPAT	**:**	Strategic Plan for Agricultural Transformation
USD	**:**	United States Dollars
VSLAs	:	Village Savings and Loans Associations
VUP	**:**	Village Umurenge Programme

CHAPTER ONE
INTRODUCTION

1.1. Background information

Rwanda is a landlocked country in the Great Lakes region of East Africa. In spite of its limited natural resources, Rwanda has achieved real GDP growth of about 9% per annum over the past two decades, during the time the population has grown at a rate of 2.6%. Given its small land area (26,338 Square Kilometres), it is now one of the densest countries in Africa. The country remains largely rural and dependent on agriculture. The strong economic growth has seen declines in poverty (from 77% in 2001 to 55% in 2017), an improvement in life expectancy (to 69 in 2019), and a two-thirds drop in child mortality, and a gradual decrease in inequality (World Bank, 2019).

Table 1.1Development indicators for Rwanda

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Total population (Millions)	10.0	10.2	10.5	10.7	11.0	11.3	11.5	11.8	12.1	12.4
Population growth (%)	2.6	2.6	2.6	2.4	2.4	2.4	2.4	2.4	2.4	2.4
GDP Growth (%)	7.3	8	8.6	4.7	6.2	8.9	6	4	8.6	9.4
Agriculture Value added (% of GDP)	24	24	25	25	25	24	25	26	25	24

Source: World Bank (2020)

The above achievement is a result of the long-term commitment that was adopted by the Government of Rwanda as an ambitious economic growth and competitiveness strategy with a clear vision of achieving upper-middle income and high-income by 2035 and 2050 respectively. The country's long-term development goal design announced in the year 2000 in the National Policy document as "Vision 2020 and Economic Development and Poverty Reduction Strategy (EDPRS)" and now vision 2050 (Republic of Rwanda, 2020). To achieve this ambitious goal, Rwanda's economy will be built on a dynamic and capable workforce, meeting the demand for high-skilled jobs, regional integration and private sector that is leading the overall national economic transformation through a series of seven-year National Strategies for Transformation (NST1). The first phase of NST1 covers a period from 2018 to 2024, which originated from the implementation of two, five-year Economic Development and Poverty

Reduction Strategies (2008-12, and 2013-18). The NST1 has been most primarily led by public investments, largely through external financing, but with an increasing emphasis on promoting private sector investment and growth (Republic of Rwanda, 2017).

Agriculture sector development in Rwanda

The Ministry of Agriculture and Animal Resources (MINAGRI) implements agricultural national and non-governmental agricultural policies in the agriculture. Its mandate is to make sure food and nutrition security while the sector contributes to the National economy by introducing, developing and management programs to transforming and modernising the agriculture sector[1]. The Ministry has two implementing bodies: the Rwanda Agriculture and Animal Resources Development Board (RAB) and the National Agricultural Export Development Board (NAEB). The RAB[2] is responsible for developing agricultural and livestock resources through conducting research and provision of the agriculture related advisory services to improve productivity. While NAEB is responsible for implementing policies and strategies to promote agricultural business growth to diversify export earnings from agriculture and livestock. Since 2017, the agency has been a commercial public institution[3]. Furthermore, gradual decentralisation has enabled local government to provide agricultural services to farmers and, to serve as a focal point to represent the needs of the local communities and coordinating multi-sector comebacks.

The agricultural services delivery unit is decentralised downwards at district, sector and cell levels where at the district a director coordinates the agriculture officer, cash crop officer, forestry and natural resources officer and livestock officer. At the sector level, there are an agriculture officer and a livestock officer while at the cell level there is an officer in charge of socio-economic development and responsible for agriculture. In addition, private sector players, non-Government organisations and international stakeholders have been played a key role in the sector development. A tradition characteristic of operating in membership-based groups around common interests to pool resources has accelerating the adoption and implementation of policies in agriculture sector. In 2017, around 8,145 farmers' cooperatives,

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[1] Prime Minister's Order No. 40/03 of 27/02/2015 determines the mission, functions, and organisational structures of MINAGRI.
[2] Law No14/2017 of 14/4/2017 establishing Rwanda Agriculture and Animal Resources Development Board (RAB) and determining its mission, organisation, and functioning.
[3] The law No. 13/2017 (ratified on 14 April 2017) establishes NAEB as commercial public entity, including a new structure.

141 unions and 15 federations and 486 Savings and Credit Cooperatives (SACCOs) were registered by Rwanda Cooperative agency (RCA).

Agriculture sector in Rwanda has found its continual long term development orientation from the first phase of the National Strategy for Transformation (NST1). The sector has been the main stabiliser of the national economy accounting for 24% of the national GDP, and a growth rate of between 5-8% in the period 2010-2018. It employs about 70% of the population and generating more than half of the country's export revenues (NISR, 2020). Tea and coffee are the major export crops while plantains, cassava, potatoes, sweet potatoes, maize, and beans are the most productive food crops. Rwanda exports dry beans, potatoes, maize, rice, cassava flour, maize flour, poultry, and live animals within Eastern Africa. The long-term vision of the country acknowledges that together with the creation of off-farm jobs, the agriculture sector will be transformed, market-driven, linked to urbanisation and trade and nearly 15 times more productive than today by 2050(Republic of Rwanda, 2020).

Although, the Rwandan agriculture is characterised by the small size of landholdings (50 percent of rural farm households farm less than 0.35 ha), land fragmentation, and the limited availability of arable land (1.5 million hectares, approximately 49% of the total land area). It employs a large number of a working-age population, and this is projected to increase from 5.2million in 2014 to 6.6 million by 2032. This remains the rural households that depend on subsistence farming and rainfed production systems. These factors have been a brake on the productivity of land and constrain the ability of smallholders to escape poverty (Nair *et al.*, 2018).

Nonetheless, as noted above, agriculture has been the main driver of growth and poverty reduction given the absolute size of the sector. The food production, crop production and livestock production indices have all increased substantially over the past 10 years (Figure1.1) as have the yields in staple crops and cash crops (Figure 1.2) as indicated by World Food Program(FAO, 2020).

Figure 1.1 Agricultural production indices (2014-2016=100)

Source: FAO (2020)
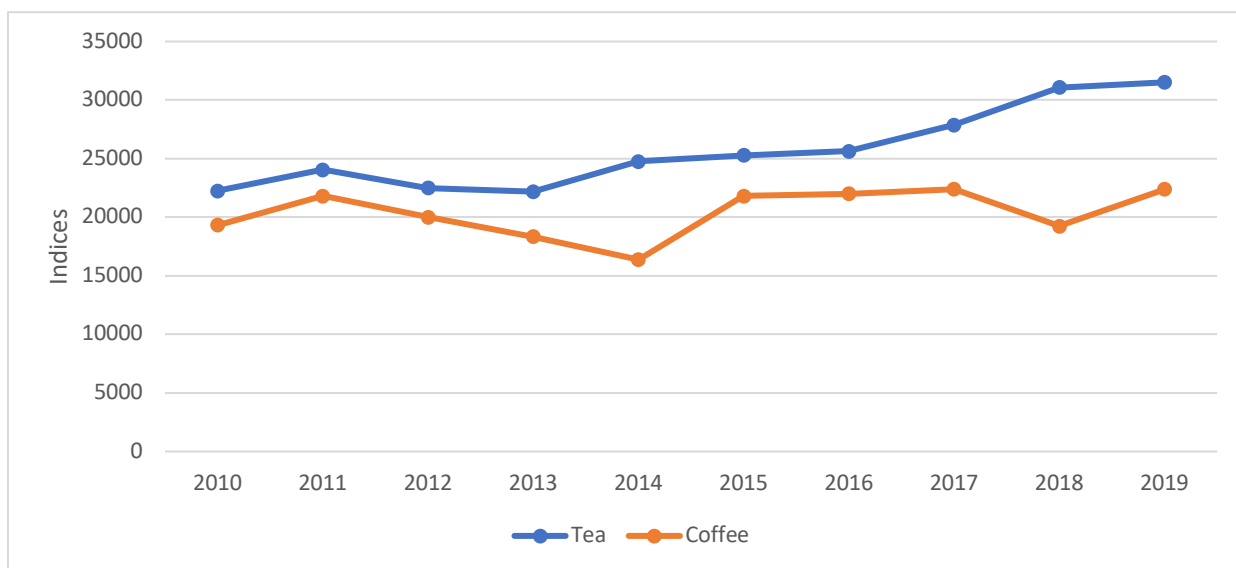
Figure 1.2 Production of commercial crops (tea and Coffee) for Rwanda in tones 2010-2019

Source: FAO (2020)

The improvement in agriculture production is a result of the National Agricultural Policy (NAP) in place since 2004. The policy aimed at contributing to the national economic growth, improving food security and the nutritional status of the population, and increasing rural incomes. The NAP was revised in 2018 with the additional goals of ensuring sustainable agricultural growth from a productive, green and market-led agriculture sector(MINAGRI, 2018b). The Ministry of Agriculture and Animal Resources (MINAGRI) formulated the

Strategic Plan for Agricultural Transformation (PSTA) to implement the NAP, through PSTA Phase 1 (2004-2007), Phase 2 (2008-2012) and Phase 3 (2013-2018), with a focus of intensification and development of value chains as the key to increase production and farmers' incomes and boost rural employment opportunities. PSTA has been a contributing factor with regard to the sustained annual agriculture growth rates in the past decade.

Presently in its fourth phase, PSTA4 (2018-2024) seeks to promote climate-smart production and resilience by improving on-farm practices to scale up land productivity and returns to farm capital and labour. Priority crops include food crops like rice, wheat, maize, Irish potatoes, cassava, beans, soybean and banana, dairy, horticultural crops (which will also improve the nutritional status of poor rural people and vulnerable groups) and cash crops led by tea and coffee. In particular, targeted export volumes for tea would increase by 73% due to increased fertiliser application from 7,000MT to 10,000MT per year, investing in high-yielding clones and increasing the land area from 26,879 hectares to 45,000 hectares (MINAGRI, 2018b).

Agriculture finance

The government is the central stakeholder to drive investment and financial initiatives for the development of rural and agriculture finance in Rwanda. The willingness is reflected in the national budget share allocated to the sector and as results, the percentage rose from 3% to 10% from 2006 to 2015, although it has fallen recently. Generally, the volume of agricultural credits that include loans for primary production, agricultural trading and agricultural processing have been increasing steadily to support the agriculture transformation and the national export strategies. Likewise, a proportion of the agriculture GDP increased from 4.4% in 2012 to 5.9% in 2015 though decreased to 4.6 in 2016 (IPAR & AFR, 2018).

The Rural and Agricultural Finance Strategy by the Ministry of Agriculture in 2012 has guided banking and innovations linkages to help the formal financial sector and to serve the informal structures−Village Savings and Loans Associations (VSLAs), collateral management, development of credit information and deal with information gaps and promoting access banking to remove the conundrum of agricultural finance(IPAR & AFR, 2018). The relationship between efficient value chains and value chain finance and interventions are also mainstreamed throughout the strategy at all stages of value chains from inputs for primary production, post-harvest handling, agro-processing and marketing. For nearly future, the public spending for the sector is expected to be increased from 5.2% (2017) to 10.4% in

2024(Republic of Rwanda, 2017). However, this alone is not anticipated to impact the growth in the sector if no more as commitment by the private sector investment from the current status. For instance, the 2020 Agriculture finance report by Access to Finance Rwanda (AFR) has indicated the slow growth and impassive private investment to the agricultural value chains where credits supply by banks increased from 21% to 26% over a period of 5 years (2016 - 2020), a lodging of a decreased rate in informal sector from 23% to 19% over the same period(IPAR, 2018).

From the government perspective, driven factors to increase agricultural finance include the land title and land tenure regularisation program from 2005. This program was among government policies developed to support the long-term agriculture finance and to improve the rural households' security against any formal credit(RNRA, 2016). The impact was then observed in the number of farmers who were able to access formal credits. For instance, borrowing from the formal financial sector increased from 9% in 2012 to 15% in 2015 where this lending sector alone increased credits for the agriculture sector from Frw 57 billion in 2012 to Frw 90billion in 2016(Issues *et al.*, 2014; Nair *et al.*, 2018). In addition, the public sector lender and the Development Bank of Rwanda (DBR) had provided around 40% of the total loans. The Microfinance institutions (MFIs) and Saving and Credit Cooperative Organisations (SACCOs) that are emerging lending sources for a large number of smallholder farmers contributed 22% of total agricultural credits. Other commercial banks shared the balance in 2016.

On top of the formal credits, the informal sector had contributed much for lending the agricultural population and its share has increased from 43% to 51 % from 2012 to 2016(Nair *et al.*, 2018). About 79% of rural farmers utilise informal sources such as Rotating Credit and Savings Association (ROSCA), tontines, VUP[4], relatives and friends for borrowing compared to 72% of the rest of the population in Rwanda. However, borrowing for the agricultural population may of different reasons, general living expenses such as school fees and health care are reported as the primary reasons for borrowing by the population in the agriculture sector(IPAR & AFR, 2018). This was because of how the rural and agricultural financial services strategy has guided the development of rural saving and borrowing mechanisms by recognising the role of emerging informal saving groups to fill the gap in the formal lending

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[4] Vision 2020 Umurenge Programme (VUP) - is an Integrated Local Development Program to Accelerate Poverty Eradication, Rural Growth, and Social Protection. This is an initiative by the Government of Rwanda (GoR) in collaboration with development partners and NGOs.

system in the rural areas. These comprise of village savings loan association, tontines, credit shops and farmers' cooperatives.

Despite efforts to ensure that, the agriculture sector keeps its pace in contributing to the gross domestic product (GDP), the positive impact was observed in the period up to 2016 and a slowdown followed in the period from 2018 afterwards and the overall financing rate in the sector remains below targets. Lending financial institutions have been reluctant to raise investment in form of loans for the sector depending on the riskier stages of value chains. Farmers in the primary production and post-harvest handling stages are running agricultural businesses with limited knowledge of climate and environmental risks with low professionalism which are attributed to the poor management of accessed loans (IPAR-Rwanda and AFR, 2018). Besides, small sizes of landholding, less-organised value chains and lack of market connectivity are discouraging characteristics to finance the sector. In the figure 1.3. the trend for medium-and long-term agricultural loans from the formal lending sources has decreased from 2011 to 2018 at an average of 2.1 % and 2.2% respectively as shown in the following figure (NISR, 2020).
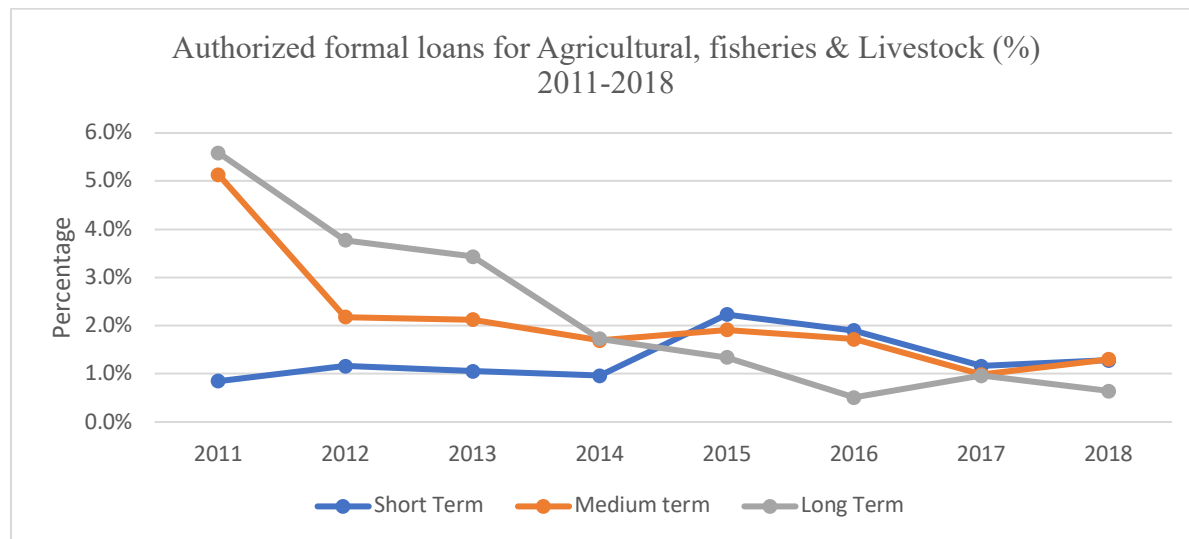
Figure 1.3 Authorised formal loans for Agriculture sector
Source: NISR (2019)

Accordingly, agricultural growth averaged 4.1% compared to the target of 8.5% and agricultural exports averaged 15% against 28% as the target over the period from 2013 to 2020 (Republic of Rwanda, 2017).

Tea sector and financing status

Rwanda has generally received good interventions to increase the access to the basic financial services for smallholder farmers starting from well-organised crops value chains targeted for agricultural transformation. Tea like Coffee as traditional cash crops introduced in 1950's and it is managed through the National Agricultural Export Development Board (NAEB). This is a public commercial institution to regulate and promote agricultural exports and facilitating private sector to access competitive international markets. The tea was among the targeted agricultural value chains to benefit from increased funding schemes throughout specific interventions made by the government and its development partners to restructure and develop the sector after the genocide against Tutsi in 1994. The reforms started with a privatisation program of public-owned tea factories in 2009, followed by specific funds to finance export crops (tea and coffee) and capacity building programs to increase knowledge and skills for tea farmers and tea pluckers to improve the production and quality of tea green leaves(Nair *et al.*, 2018; Stone *et al.*, 2011). The most known tea expansion and capacity building program was an initiative of the government and its partners to improve tea production of green tea leaves in South-West regions of Rwanda(NAEB, 2017a). From 2012, farmers were expected to develop new tea plantations, planting high yielding tea clones and increased the application rate of input fertilisers and increased knowledge and skills to improve quality of tea alongside treatment activities from farm to factories for farmers and tea pluckers.

The regular Government and stakeholders' efforts to support the development of tea sector have increased the competitiveness of the Rwandan tea on the international markets for both production and quality of black CTC (Cu, Tear, Curl) tea[5]. The commitment has made tea value chain ranked among fast growing value chains to boost national exports volumes and revenues. The most impacted tea expansion program in the Southern- west provinces has increased the production from 20,741 tones in 2010 to 34,498 tones in 2021 (Figure 1.4) and made USD 90million export revenues in 2020-2021.

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[5] CTC type is dominantly produced in Rwanda
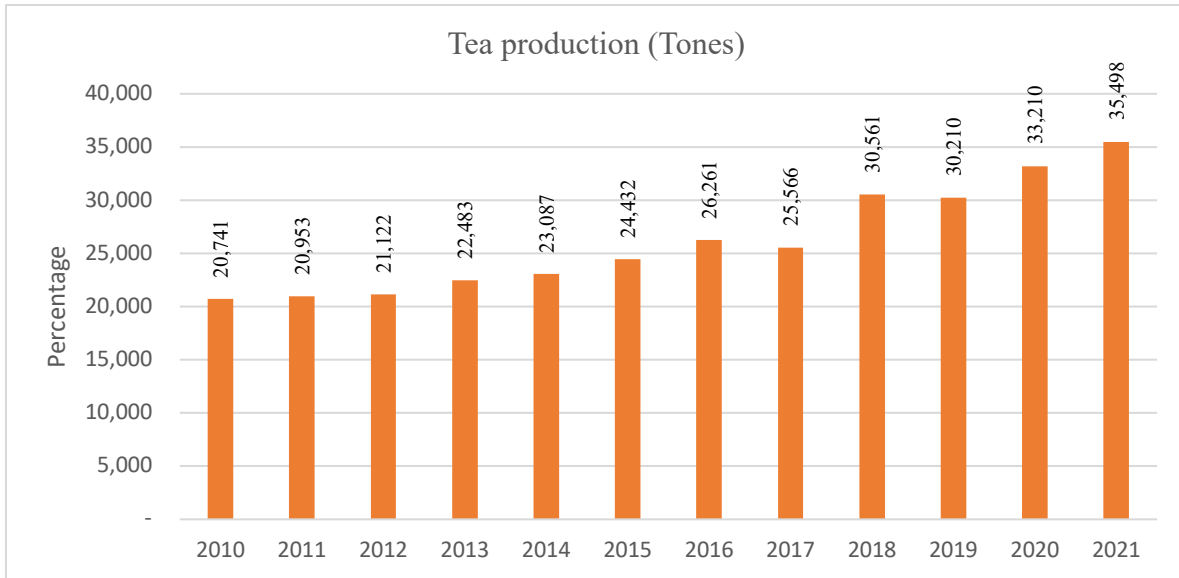
Figure 1.4 Production in Volumes 2010-2021

Source: MINAGRI (2021)

This has boosted the demand for farm credits and their significance for smallholder tea farmers in perpetuating farm productivity and income is unquestionable. Because it is a means to achieving optimal productivity. The next five years from 2012, the share of the tea sector for total loans remained at an increasing rate though it was slightly decreased in 2016. (NBR, 2018).
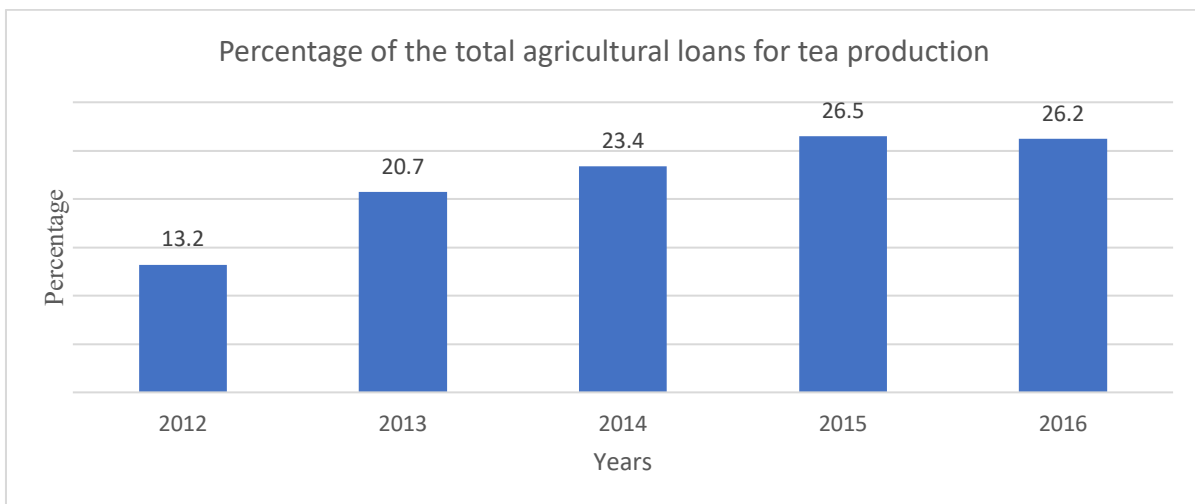
Figure 1.5 Total loans for tea production

Source: NBR (2020)

As aforementioned, tea is among the value chains that has the Government's focus to secure long-term balance of payment. The sector is also among well-organised value chains where buyers, technical assistance, inputs and credits suppliers to farmers have always kept long-term secured business relations. For example, FERWACOTHE is the national federation of 21-

member tea cooperatives with about 43,000 tea-leaf producers(Nair *et al.*, 2018). Along with its member cooperatives, FERWACOTHE is involved in procurement and distribution of input fertilisers whereas individual cooperatives facilitate their members' access to financial services. In most cases, credits in the form of input fertilisers are channelised through farmers' cooperatives. Members secure access to input fertilisers based on projects presented through cooperative management, which are mostly to seek for operation capital investment to develop and expand tea production more clearly to pay for labour and high yielding tea clones. In this way, tea credits are repaid by deducting the amount from paid for the supplied green leaf to the factories. However, the mechanism is not replacing individual borrowing by utilising different lending sources for credits and mostly using tea plantations as financial security.

1.2.Statement of the problem

The Government of Rwanda has adopted an ambitious growth and competitiveness strategy with a clear vision of achieving upper-middle income and high income by 2035 and 2050 respectively. The National Strategy for Transformation (NST1), the Government's seven-year implementation program for 2017-2024, has among priorities a transformed agriculture from subsistence to market-oriented and climate resilient agriculture where over all commercialised high value chains will contribute to the GDP a 21% by 2035 and 16% by 2050 from 24% in 2020 (Republic of Rwanda, 2020). Creating inclusive financial opportunities for farmers, increased rate of modern inputs and technologies to maximise productivity at farm level targeting commercialised agriculture value chains led by cash crops as Tea and overall to secure high standards of living for all Rwandans.

Tea sector was the first commercialised value chain to give lesson from 2012 where this sector was supported along its value chain targeting to empower tea farmers both in terms of skills capacity and inputs to increase productivity that can satisfy demand for green tea leaves by existing and new established tea factories in Rwanda. The Government of Rwanda has invested in tea expansion programs through providing incentives and facilitation of investors in tea production projects to rise tea exports volumes and revenues. The Government's commitment targeted investors to build new tea factories or for expansion of existing capacities, on another side, farmers were at the helm to increase production and farm capacity to meet demand for green tea leaves. This last has encouraged demand of farm credit to invest in agricultural inputs (fertilisers and equipment) and high yielding clones as tea seedlings and expansion of areas for tea plantation. A total of 8.9 billion Rwandan francs was to be mobilised to reach USD

147million as foreign earnings by 2017 from USD 61million in 2011. The budget would be spent in various forms of credits and direct support for capacity building programs to tea farmers.

Furthermore, the significance of tea credits for smallholder farmers in perpetuating farm productivity and income is unquestionable because it is a means to achieving optimal productivity. To keep the national trend as targets in tea sector, the government has renewed its commitment to mobilise funds for farmers in the tea value chain was to improve the yield from 7MT/ha to 9MT/ha by 2024 to export up to 73% of tea export volumes that allowing tea factories to operate at the maximum capacity (MINAGRI, 2018b). Nevertheless, the statistics have shown that a good deal has not met the eye within tea value chain on the performance indicators. For instance, from the 2017 target, tea export revenues did not exceed a 57% as USD 84 million and even in 2020 as USD104 Million against USD 147million set back in 2017 (FAO, 2021). A correlated factors include poor performance of credit inputs that were to be utilised for tea production and then did slow farm productivity and asymmetric information between tea farm credit users and bankers that generally misread policy makers about risks connected to agricultural activities hence determine loan size and type of lenders for applications. The fact is that depending on stages along crops value chains (production, processing, value-added and export), the volume of credits allocated to tea value chain has been on a decreasing trend because of the high rate of credit mismanagement as reported by involved Development Bank of Rwanda (IFAD, 2017) and the National Bank of Rwanda for non-performance loans (NPLs)(NBR, 2019).

Despite the strong case for further investigation in a particular context, generally, some reports by public agencies and researchers had revealed the causes including the limited managerial skills and systems that affecting the quality of loan applications and management of farm credits approved to tea farmers and farmers' cooperatives(NAEB, 2013). Others attributed high non-performing loans (NPLs) to genuine business failures from limited managerial skills to run viable businesses(Papias & Ganesan, 2010), undermining the climate incidences and particular challenges related to seasons and product sales(Alio *et al.*, 2018) that financial products are generally tailored to the small and medium enterprises (SMEs) microfinance models which do not necessarily correspond to the seasonal nature of agriculture in general (IPAR & AFR, 2018). Also, asymmetric information as distrust between lending institutions and borrowers, in this case, smallholder farmers(Rondhi *et al.*, 2020). Another defining characteristic of tea

farmers is being highly engaged in off-farm activities (Taremwa *et al.*, 2021). Worse still, they have unescapable living and consumption expenses within their households(NISR, 2020). In addition, supervision reports of government's partners for tea sector development showed that Utilisation of tea funds remains suboptimal by indicating the size of abandoned tea plots, the lessened productivity and worse still, the outstanding bank credits registered for tea cooperatives(IFAD, 2017; NAEB, 2013). More interestingly, the present research targets tea credits utilisation that was missed in the previous studies to understand the performance of credits on tea farm level in the sector.

In gap to the previous studies is they were focused on the credit demand side and driven factors for borrowers to win the deal, this study is likely to help understand the credit utilisation side in particular the agriculture sector. With respect to raised concerns for tea credits mismanagement, an empirically grounded typology of driven factors of credit utilisation is necessary particularly among tea farming households to understand why tea credits should strictly be used for agreed tea projects; all in a bid to lessen their diversion and thus improve tea farm output and income. Finally, to inform policymakers and stakeholders of needed revision to improve management of tea funds. It is against this background that this study was set out to contribute to further financing decisions and interventions for the tea sector development in Rwanda.

1.3.Research objectives

1.3.1. *General objective*

To contribute towards sustainable management of tea credits and tea production by determining responsible factors influencing utilisation of tea credits and their effect on farm income in Rwanda.

1.3.2. *Specific objectives*

The study had the following specific objectives:

i.   To determine factors influencing tea farmers' utilisation of different sources of credit in Nyaruguru District, Rwanda.

ii. To analyse the factors influencing the utilisation of credit for tea enterprise among farmers in Nyaruguru District, Rwanda

iii. To assess the effect of credit utilisation on tea income among tea farmers in Nyaruguru District, Rwanda.

1.4.Research questions

i.   What factors influence the utilisation of different sources of credit by tea farmers in Nyaruguru district?

ii. What socio-economic and institutional factors influence the utilisation of credit for tea enterprise among farmers in Nyaruguru district?

iii. What is the effect of utilising credit (based on tea enterprise) on tea farm income among tea farmers in Nyaruguru district?

1.5.Justification of the study

Today, improving farm productivity requires to adjust farm inputs and modern technologies. This creates a burden for smallholder farmers who inevitably need to increase the capital investment to meet farm operating costs. Access to credits and evaluation has its challenges and policy actions proposed to promote inclusive finance and uplifting small scale farmers from particular context and policies' intention. Utilisation of credits accessed, and level of performance has another tone for both lenders and policy decision makers that will drive the next steps whether to extend the programs or shift to alternatives. The first have been a focus for most studies to recommend the strategies of increasing finances in the agriculture sector however the second has been of less focus and yet credits performance drives decision towards change needed in the next phase and financing decision.

To the best of knowledge, incidences of mismanaging tea credits among individual tea farmers in Rwanda, study findings have left ambiguous for farmers' behaviour towards credits utilisation which connected to the farm performance in terms of productivity and revenues. This is because, a farmer within the household models is assumed optimist, rational, budget constraint and risk-averse for any made decision he or she is utilising the available and scarce resources. In this way, investment opportunities are given priority based on the high expected utility. If it is to follow a loan contract, mismanaging credit may have altered definitions when this affects planned project outcomes. In this case policy actions can go far beyond financial education strategies.

In Rwanda, credits allow farmers in tea value chains are expected to allow them to positively respond to processing factories' demand for green tea leaves supply and hence targeted national export volumes. At the national level, the utilisation of tea credits for the presented projects implies a lot for the National Export Strategy (NST1) targeting to increase export volumes of

processed tea. Generally speaking, policy interventions in tea sector in Rwanda were planned and implemented based on the long term Government will and vision to become a middle income country by 2035 and high income country by 2050. As strategies include to be competitive in the international markets for exports through improving quality and volumes in commercialised value chains. However, there are internal factors in particular at farmer and farm levels where evidence-based planning and implementing activities can further be strengthened. For instance, operating rate of tea processing factories, international logistics and contracts with buyers are all depending on the performance of individual tea farmers who own 70% of national tea plantations. Failure to understand the factors that could slow the production of green tea leaves at farm level will not impact the productivity but also the overall targeted living standards among rural communities whose lifestyle depends on daily tea production activities.

The present explanations on the gap to reach targeted goal in tea production have no evidence-based research to guide policy makers on possible changes needed at farm level. In order to support on-going investment for tea production and bridge the evidence gap for planning, implementation and evaluation of investment performance in Rwandan tea sector, it is crucial to conduct research and performance analytics to be able to inform Government and its partners in the sector. The knowledge about driven factors is of great policy relevance for further financing modes. Besides, evidence-based study on the impact of credits utilised on the farm income is expected to complement the existing literature and a substantial tool for farmers' mobilisation and stakeholders to finance the tea sector. The econometric models used for data analysis are also contributing to sharing knowledge about their application and further, they can be used in another research.

The findings of this study will benefit stakeholders throughout the whole tea value chain. Government and its partners in the sector will be able to understand the need and remedial strategies, approach and interventions to stop incidences of credit diversion. Finally, the empirical findings contribute to the body of knowledge on credit utilisation and impact on farm outputs at small-scale farmers in the context of developing countries.

1.6. Limitations of the study and assumptions

The study was restricted to the district of Nyaruguru to represent not only the areas with tea production as a major economic activity in the country but also the region from which a tea

expansion program has been implemented since 2012. The study considered data on tea production and credit utilised by tea farming households over the last three fiscal years from 2016/2017 to 2018/2019.

The study has given much importance to off-tea farm uses by received tea credits; this is because the approved tea credits were strictly supposed to be utilised for tea production. Any other off-tea farm uses of received credits was classified among credit diversion case. The study also followed research guidelines for survey-based research, design, techniques and instruments to minimised errors that could be generated by cross-sectional data type. Hence, piloting was carried out before the extended survey.

Finally, based on the literature about econometric models and their distinguished analytical power for quantitative analysis, the study assumed econometric the selected models are appropriate for the analysis. It was also assumed that the built-in endogenous switching regression model has the capacity to systematically account for the endogeneity effect during analysis.

1.7. Definition of terms

Access to credit- a farmer has access to credit from a particular source if he/she is able to borrow from that source, although for various reasons he/she may choose not to borrow. The extent of access reflects a maximum he/she can borrow, that is a credit limit. If this amount is positive, the borrower is said to have access.

Source of credit – In this study, this has meant any formal or informal lending agent or institution that lending money or equivalent with or without interest rate to be reimbursed within the agreed period by both two parties under certain conditions. Source of credit may be banks, traders, cooperative societies, landlords, moneylenders, relatives and friends.

Credit utilisation via Credit utilisation index – Credit utilisation is understood as how someone uses and or rationally allocate the credit approved and how disciplined that person is in credit use. In this study context, credit utilisation means the way farmers who had received tea credit had used it for tea production purpose otherwise if was utilised out of tea enterprise, it intended credit diversion.

In chapter four, credit utilisation was defined as the quotient of the difference between the total amount of tea credit received and the amount of credit used to off-tea farm uses and the total amount of credit received. Alternatively, utilisation of the credit is equal to 1 less the value of the ratio of the amount of credit used to off-tea uses and the total amount of credit received. In this way, the credit utilisation rate values were ranging between 0 and 1. If the credit utilisation index (CUI) is zero, it means the user has fully diverted credit from proposed tea production projects while when the index is equal to 1, this implies that the user farmer has fully utilised credit for intended tea production activities.

Credit diversion- There are overlaps in two terms "credit diversion" and credit diversification" for the side of a borrower but not for the lending institution's side. In this study, credit diversion should not be confused with credit diversification. The first term was in the case when approved tea credits were used for off-farm tea uses such as household consumption, or social events and off-farm businesses like buying and selling livestock, opening a small shop, tax motors, conducting shop businesses among others. In contrast, the second term was avoided in the current context but it meant the case in which credits have been utilised to minimise the risks/increasing income by running various activities/businesses.

Factors - Sometimes these have been used interchangeably with *"determinants"* to mean different pre-conditional characteristics or attributes defining eligibility on something or otherwise. Factors were defined for this study as any factor that is influencing a farmer's decision to utilise the credits for tea production purpose or otherwise.

Smallholder tea farmers- A smallholder tea farmers term has been used depending on the context, country and even ecological zone. In Kenya, it means a farmer who is cultivating tea and he/she does not possess her or his processing factory. In Sri Lanka, a smallholder should have an area of land less than 50 acres (20.2 Ha). In India, he/she must hold less than 10.12 Ha and does not possess her or his tea processing factory. In Rwanda, a smallholder tea farmer is the one who is producing tea and supplying his/her produce (fresh green tea leaves) to the nearest tea factory because he/she does not own a processing tea factory.

CHAPTER TWO
LITERATURE REVIEW

2.1. Introduction

Africa remains the world continent with high potential economic revolving and holds a strategic position for its vast, untapped resources. Therefore, a great deal has yet to be learned about its potential prosperity. It is home to more than 50 different countries with close to 2,000 spoken languages and various cultures. It is the second world populated region next to Asia (Worldmeter, 2021). Almost African countries all have a similar history for their political and economic revolution from North-Western settlers. This is probably the origin of most cash crops that were introduced and produced across the continent. Among these cash crops include Tea and coffee. Tea plantation was introduced by British settlers at first for their consumption and later for commercial growing. Tea production is expanding in East and Central Africa, with consumption growth in the North and West of the continent. Malawi was the first African country to grow tea in the 1880s, followed by Kenya in 1903s, then by Tanzania in 1926s. Other countries received tea crop during the booming independence period. Rwanda started producing tea during the 1950s, Zimbabwe in the 1960s, Burundi in the 1970s (Ninsiima & Chung, 2016).

One thing these nations all have in common is an appreciation for tea flavour quality. Tea plays a central role in social ceremonies across the African region. The type and style of serving tea differ across countries in the continent and across cultures, where each culture has an attractive and distinct diversity of tea. Tea is an important crop among drinking and its value has been appreciated differently depending on the culture and context of each country. Research indicates that it is served as a refreshment to accompany meals or is offered as a show of hospitality to the guests (Ninsiima & Chung, 2016). In Africa, tea is mostly preferred when it is flavoured with mint and sugar (Kuoni, 2021). In the international markets, the increasing tea manufacturing of teabags demanded more and more small particles of black tea in particular during the half of the 20th century. The CTC (Cu, Tear, Curl) machines were invented and increasingly installed in tea growing African regions, and in Rwanda as well, to manufacture large quantities of those small fast brewing particles for export.

In addition, African tea production plays a vital role in the global economy where it represents the biggest share of the world's tea exports with 33% percent of internationally traded tea and

374th most trade product of worth USD7.7billion (ITC, 2021). Although the total African tea production represents a small share of the world, which is dominated by China and India, its export growth rate grew at 25.8 percent over the past 10 years until 2017 (ITC, 2021). Global statistics on tea trading showed in 2020 that China was still leading top tea exporter countries followed by Sri Lanka, Kenya and India and United Arab Emirates. On importing side, Pakistan, United States, Russia, United Kingdom and Hong Kong were the most importers of tea respectively. The pivotal position of Africa for tea exports is expected to grow even stronger as competing countries; China and India continuing to gear up domestic consumption which is different for African tea producing countries that consider their tea as an export crop. At the continent level, Kenya is leading tea export volumes while Morocco is the most tea importing African country by 2020. Furthermore, the African countries' tea taste is appreciated by international blenders. African tea is delicious, earthy, and hides a very special warm character that is unique globally. The Simple Loose-Leaf Tea Company (SLLTC) has attributed this quality is to the unique agro-climatic of the geographical areas of Africa which are characterised by hot weather, rich dark red soil, tropical and sub-tropical climates and a lot of sun(Jean de la Paix *et al.*, 2011). Therefore, there is still an opportunity for African countries to increase production acreage, especially through the smallholder sector, while research is delivering cultivars with higher yield and quality potential and improving management of a related investment.

This chapter reviews the work of different publications in the area of tea industry development and their theoretical groundworks in Rwanda and other African countries. The subsequent four sections provide an overview of African tea in the global economy, the tea industry in Rwanda, the lending market in developing countries and credit use in the Rwandan agriculture sector in particular foundation of investing in tea production. The next part reviews some empirical studies on econometric models used for this research. The last two subsections of this chapter end with the theoretical framework and conceptual framework.

2.2. Overview of Tea Industry in Rwanda

2.2.1. Geography, Agriculture in Rwanda

Rwanda, with its capital City, Kigali, is a landlocked high-hilled country in the heart of Africa with rolling hills and valleys geography. The country is labelled "Land of a thousand hills". It lies between 1º 04' and 2º 51' latitude South of the Equator and between 28º 53' and 30º 53'

longitude East of Greenwich Meridian. It is a small country with a size of 26,338 square Kilometres where water and land occupy about 1,668 and 24,670 square kilometres respectively. It is also among the most populated countries in Sub-Sahara Africa with an estimated 12.6 million in 2020 and projected to be 17.5 million by 2035(NISR, 2020c).

Rwanda is bounded by four countries; to the North by Uganda, to the East by Tanzania, to the South by Burundi and to the West by the Democratic Republic of the Congo (Figure 2.1). From the Northwest -Volcanoes region- where Karisimbi, the highest volcano has 4, 507 meters (14,787 feet) – the altitude drops to 1,220 meters (4,000 feet) in the marshy Akagera river valley in the East[6]. The combination of steep slops, poor quality, abundant rainfall and intensive farming is the general cause of a variety of problems such as soil erosion, draught, floods and famine observed in the country which requires a troublesome investment of time and energy to curtail.

Figure 2.1D-Maps/Map showing position of Rwanda in Africa
Source: World Map (2020)

The annual average precipitation for Rwanda ranges from 1,000 to 1,400 millimetres (40 to 55inches) depending on the area. The highest rainy season is from September to May while the dry season is observed from June to August. The average temperature is 26/27 degrees Celsius

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[6] Rwanda | Culture, History, & People | Britannica

during the day and around 15/16 degrees Celsius at night as it is daily monitored by the Rwanda Meteorology Agency (RMA, 2021).

Agriculture is the major employer sector for Rwanda population where about 70% of the population currently earning their livelihoods in agriculture and contributes about a third of Gross Domestic Product (GDP) (MINAGRI, 2018a). The agricultural activities occupy 62.9% of the country's arable land for major crops such as maize, wheat, banana, beans, cassava and rice while tea and coffee, the two permanent and commercialised crops alone occupy around 24% of the land-use surface(Clay & Zimmerer, 2020). The agriculture production system in Rwanda is predominately small-scale farming (about 72.4%) by around 89% of people who are actively employed in primary production activities. In Rwanda, the average farm holding is hardly reaching 1 hectare per household, and it is typically divided over four to five plots located in different areas(Clay & Zimmerer, 2020; Nsabimana *et al.*, 2021).

2.2.2. Rwandan Economy performance

Rwanda is a member of three Regional Economic Communities (RECs), namely the East Africa Community (EAC), the Common Market for Eastern and Southern Africa (COMESA), and the Economic Community of Central African States (ECCAS). Such membership creates opportunity to diversify trade; however, it may also create trade diversion and complication. The country competitiveness might be different for the different RECs and that may create contradictions. Moreover, harmonisation and compliance to the different RECs is posing a great challenge. Therefore, it is important to examine the country's participation in regional trades and the effects of membership to multiple RECs in particular where Rwanda have a comparative advantage for key agricultural crops that represents around 60% of total trade statistics for Rwanda.
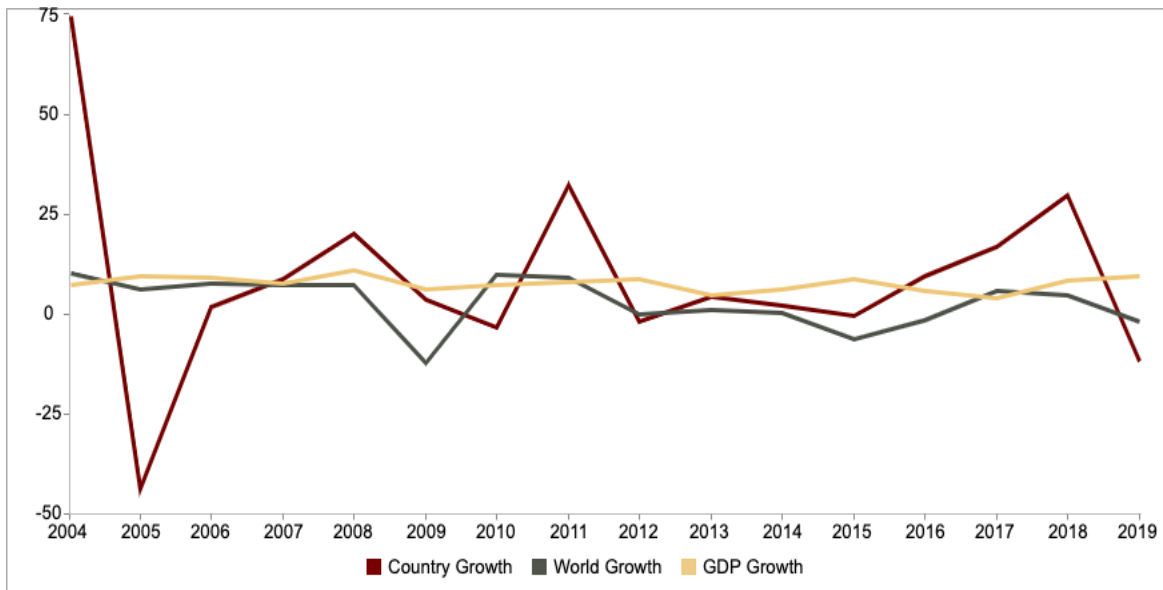
Figure 2.2 Rwanda country growth versus world growth versus GDP growth

Source: MINICOM (2020)

The figure 2.2 shows that over the period from 1998 to 2022, Rwanda exports generated an average of USD 96.22Millon (Figure2.2). This is greater than USD590.80Million in 2012 and USD37.16Million in February 2016.

Rwanda's agricultural exports is much dominated by tea and coffee and with premising horticultural crops like flowers and essential oils with exponential trend. The Clay and Zimmerer (2020) revealed that these export commodities have taken more than 90% of the total export crops value, given the importance of agricultural crops in Rwanda's exports. The export agricultural crops, whose prices are subject to fluctuations on the international market, occupied an important part of the country's foreign earnings. From the past period until the present time, tea exports value has exceeded that of coffee exports.

2.2.3. Tea industry in Rwanda

Tea as a plant - *Camellia Sinensis* - belongs to the Theaceae family originating from Southeast Asia and it was known back to the 3rd millennium BC(Mitra & Khandelwal, 2017; Sarkar *et al.*, 2016). Tea production in Rwanda has been produced since 1952 by European settlers. Since then on, tea has become an economic activity for mainly export. Tea cultivation progressed on a small scale and currently expanded in Northern, Western and Southern provinces. Rwanda is naturally advantaged for tea growing factors because of its ideal climate, tropical, volcanic soils and well-distributed rainfall throughout the year. In Rwanda there are more than 28,000 hectares planted with tea on hillsides and drained marshes with an altitude range from 1,550 m

to 2,500m in the Southern, Northern and Western provinces as shown in the figure 2.3 (IFAD, 2005). Since its introduction into country, tea estates were fully public owned companies and surrounding population was only benefiting for selling their time in plantation for plucking and mostly paid a casual wage however tea plantations have been expanded by out-growers' services companies as private investment known as "tea villagois" around public estates until the period of privatisation of public tea factories and surrounding tea plantations to private owned companies in 2004. After this period tea production became privately owned businesses in producing areas and by 2020, all 18 tea factories operating in Rwanda were supplied with green tea leaves by about 43,000 individual tea farmers who are operating in 21 cooperatives.
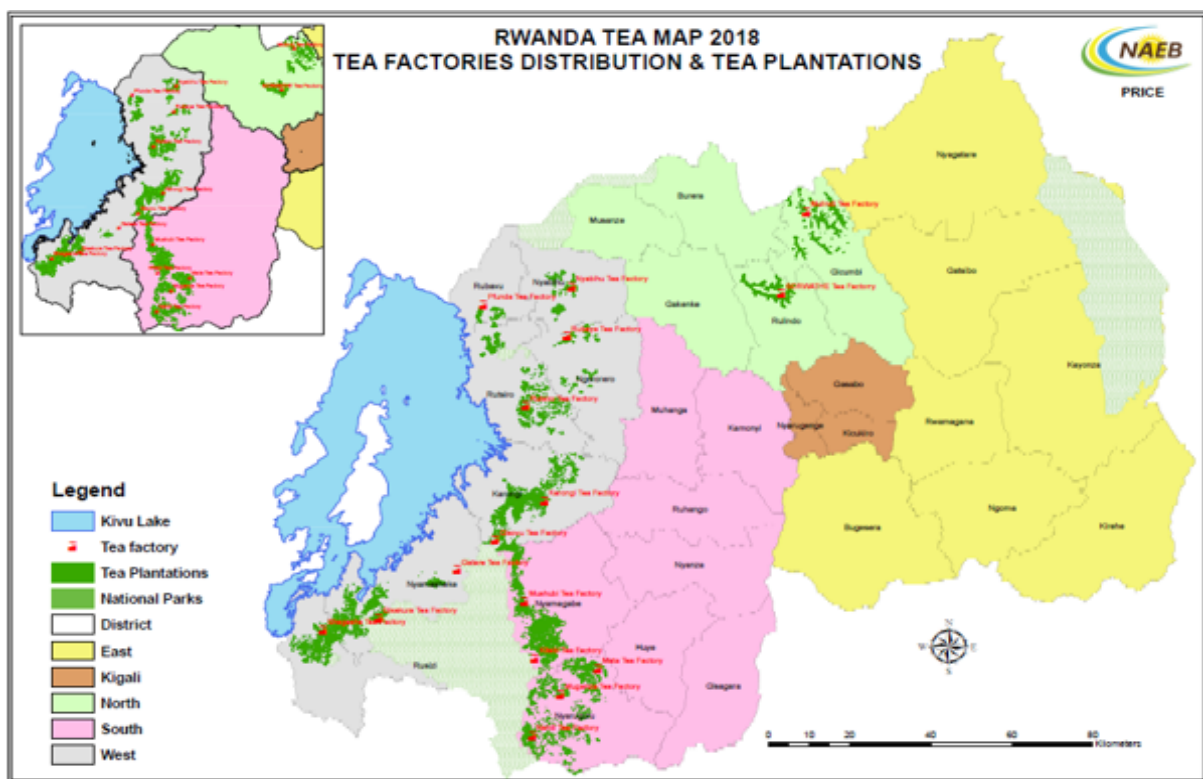
Figure 2.3 Rwanda tea Map (tea plantations and tea factories distribution)
Source: NAEB (2018)

Tea production in Rwanda has grown steadily over the years from 5,910 tones of black tea in 1980 to 13,644 metric tons (MT) in 1992 on areas of 12,566 ha by eleven (11) tea factories that were in place and 34,735 tones of black tea in 2020 produced by 18 privately owned operational tea processing factories (Figure 2.4). Similar to all economic sectors, tea was affected by the onset of the genocide tragedy of the year 1994, which caused the production to decrease steadily. As result, there was a decline of the production declined to 4,136 MT of black tea. It

took some years to regenerate until the sector reform in 1999 where the government launched the privatisation process of all public tea estates and tea factories to improve production and export volumes while attracting foreign investment. The trend of achievements was also a result of the Government tea expansion programs from 2012 where tea farmers received technical support as on farm training to improve agricultural skills and financial support in the form of credits as both cash and agricultural inputs (fertilisers and equipment) and development of tea clones with high yielding capacity.
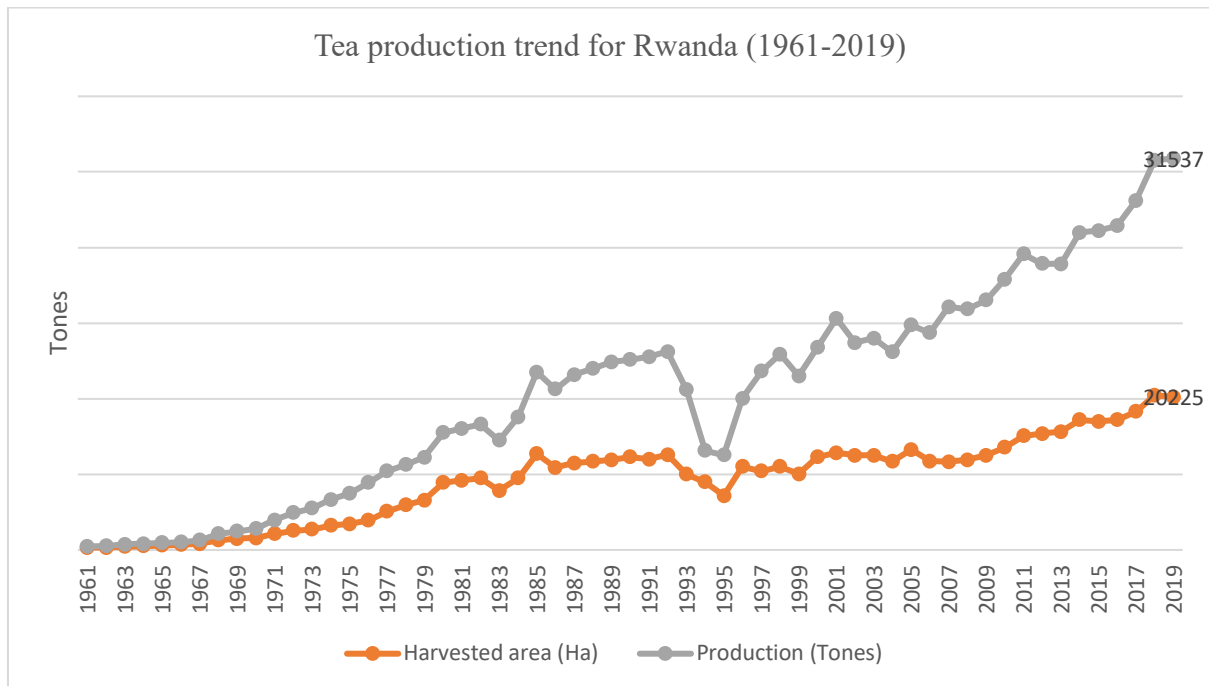
Figure 2.4 Tea production for Rwanda (1961-2019)
Source: FAOSTAT (2020)

Following the privatisation process of public owned tea factories and estates (a producing unit including factory, a plantation and associated forest to provide fuel wood to the factory for tea processing), the tea expansion program started in 2012 to increase the land area for tea plantations development. The program targeted areas in the higher elevation of Southern and Western regions of the country (around Nyungwe Natural Forest). These regions are characterised by acidic soils and less productive for other food crops. However, the soils are appropriate to intensify tea production. Nyaruguru District in Southern Province stands for the current study case and is among of these regions have tea production activities as main economic activity for population in the area.

The Rwandan tea investment deal through privatisation was that the private owners as they operate tea processing factories, they should also participate in the capacity building programs

to increase the capacity of tea growers who were expected to own tea plantations and occupy tea leaves production activities to feed these factories. The privatisation process combines efforts of the government for subsidising fertiliser chemicals and policy support, increasing private investment, and supporting farmers' organisations to improve capacity building. Tea is currently one of few labour-intensive crops that provide regular cash income and employment opportunities to the people in the study area and in the rural areas of the country. Over 143,374 both casual and self-employed people are engaged in tea production activities(Minagri, 2019). Today, the Rwandan tea sector consists of 18 tea factories that are privately owned companies, and more than 43,000 independent smallholder farmers owning nearly 70% of the total hectares of tea plantations (both privatised public tea plantations and privately developed plots). Small-holder farmers are operating in 21 tea cooperatives. Although tea factories are operating nearly at 69% of their installed capacities (except one Nshili tea factory), the annual production of made black tea in terms of the volumes has been constantly increasing from 14,391 MT to 22,249 MT, 32,127MT and 34,735 MT in 2000, 2010, 2019 and 2020 respectively (NAEB, 2021).

Rwanda is however the smallest tea producer in the East African region (Figure 2.5) because of its smallest areas that also determine the size of land for tea production and production capacity. In addition, the cost of tea production at the farm level is still high when it is compared with that from other regional countries such as Kenya and Uganda. With no doubt Rwanda has no single fertiliser manufacturing factory and to have input fertilisers, the country does import all chemical fertilisers from the East African region mainly from Kenya and Tanzania. Poor infrastructures in rural areas are, however, a factor contributing to the cost of tea production in Rwanda compared to the countries in the region. Limited infrastructure such as feeder-roads which could allow inputs distribution to the farmers and transportation of tea green tea leaves from farms to the factories contributes to the cost of tea production at farm level (Foster & Graham, 2015).

Tea production (Tones) in East African Regional Countries
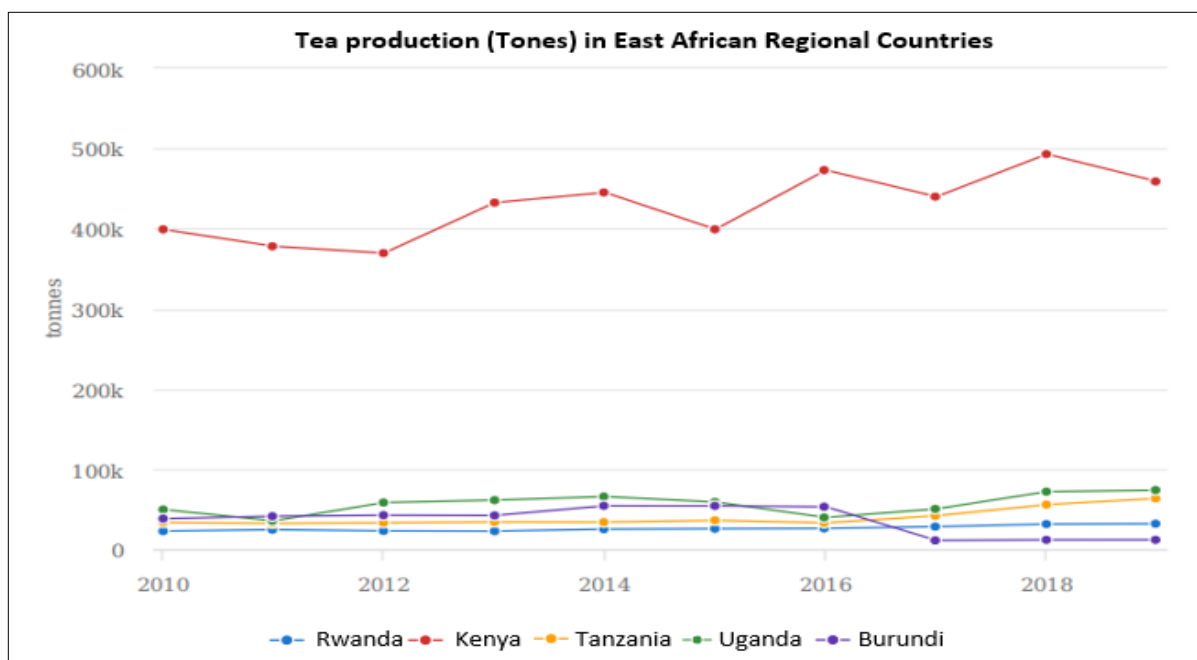
Figure 2.5 Tea production in Rwanda by comparison to regional countries
Source: FAOSTAT (2020)

2.2.4. Tea value chain in Rwanda

Tea as green tea leaves and raw materials for processing factories is produced by individual smallholder farmers, tea cooperatives, and tea factories' owned tea plantations through labour-intensive processes. Smallholder farmers own over 70% of the total tea plantations in the country for tea green leaf production. These farmers are operating in tea cooperatives that were formed around each tea factory. The logistics and activities of recording and moving green tea leaves to the nearest factory are undertaken by tea cooperatives.

Currently, the Rwandan tea sector accounts for sixteen (18) privately owned operational tea factories and twenty-one (21) collaborative tea cooperatives. Furthermore, tea plantations are also classified as tea estates, consolidated tea blocks, and tea out-growers. Tea estates are mostly tea blocks that are close to and part of tea factories. The estates are formerly public-owned tea blocks that were transferred to private owned companies through the national privatisation process. Green tea leaf from these estates is harvested by employed tea pluckers. The second category of consolidated tea blocks is land-sharing tea cooperatives and smallholders or groups of farmers who jointly share and manage tea plantations. The obtained profit is then distributed among members. The last category of tea plantations comprises of individual farms that is owned by households or smallholder out-growers. Tea out-growers own over 70% of the total tea plantations in the country(NAEB, 2019). Currently, the tea

38

production structure in the country is designed in a way that investors must install tea factories nearly and between areas of newly developed tea plantations, to reduce the time for transportation of green tea leaves from the farms since processing activities have to be done within a few hours after plucking and right after green tea leaf delivery. Therefore, any developed new tea plantations on expanding lands require installing a new processing factory.

Table 2.1 Rwandan tea factories and collaborative tea cooperatives

Tea factory	Owner	Collaborative tea cooperatives	District	Province
Sorwathe Tea Factory	Tea Importers	Assopthe	Rulindo	North
Mulindi Tea Factory	Wood Foundation	Coopthe Mulindi	Gicumbi	North
Muganza Tea Factory	Muganza Kivu tea company	Coothemuki	Nyaruguru	South
Nshili Kivu Tea Factory	Nshili Kivu tea company	Coothenk	Nyaruguru	South
Mata Tea Factory	Tea group Investment	Cothenya	Nyaruguru	South
Gatare Tea Factory	Rwanda Mountain Tea	Cothega	Nyamagabe	South
Mushubi Tea Factory	MultiInvestment Group	Cothegab	Nyamagabe	South
Kitabi Tea Factory	Rwanda Mountain Tea	Kobacyamu	Nyamagabe	South
Rutsiro Tea Factory	Rwanda Mountain Tea	Rutegroc	Rutsiro	West
Karongi Tea Factory	Karongi Tea Company	Katecogro	Karongi	West
Pfunda Tea Factory	Mcleodrussel	Cootp	Rubavu	West
Rubaya Tea Factory	Rwanda Mountain Tea	Cootragagi	Ngororero	West
Shagasha Tea Factory	Wood Foundation	Coopthe Shagasha	Rusizi	West
Gisovu Tea Factory	Mcleodrussel	Coothegim	Karongi	West
Gisakura Tea Factory	Tea Group Investment	Coopthe Gisakura	Nyamasheke	West
Nyabihu Tea Factory	Rwanda Mountain Tea	Coopthega	Nyabihu	West

Sources: NAEB (2019)

The Rwandan made black tea takes different stages from farm to local and international markets, from input fertilisers procurement and supply of tea green leaves to the factories up to the exporting stages, which are managed within the country (Figure2.6). As aforesaid, Rwanda is net importer of chemical fertilisers from the region by private importers having contracts and import license by the Government of Rwanda. The imported fertilisers are then distributed by local sellers and distributors. Tea growers obtain fertiliser chemicals from licensed local input sellers and distributors registered by the Government through the Ministry of Agriculture and Animal Resources (MINAGRI) and its affiliated agency Rwanda Agriculture and Animal Development Board (RAB). Individual farmer can make an order by

indicating the type and quantity of fertilisers using a smartphone and get confirmation matching with the size of land registered on seasonal basis. These subsidised inputs are directly paid by either tea growers or get them through tea cooperatives or tea factories that are mostly taking responsibility of purchasing input fertilisers in bulk and manage their distribution to member farmers. This last procuring mechanism facilitates the maximum of smallholder farmers to use inputs in their farms and later they pay by deducting a certain amount paid per kilogram of supplied green tea leaves to the factories.
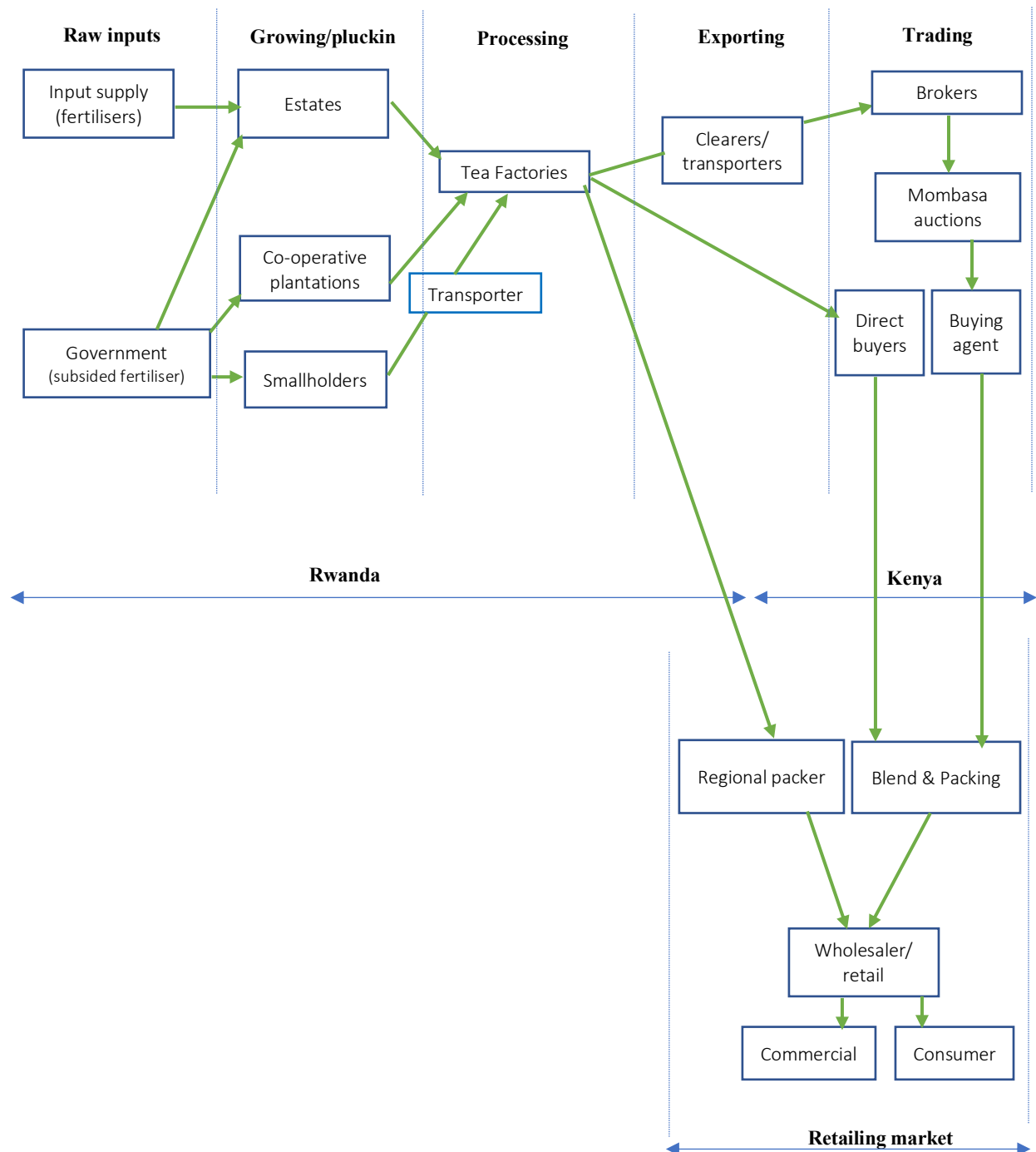
Figure 2.6 Detailed value chain for Rwanda tea production

The production of "made tea" from processing tea-green leaves is fully carried out through a chain of CTC (Cu, Tear, Curl) machines owned and managed by private companies that further act as the exporters and negotiators on the international market(NAEB, 2021). The Rwandan tea of black CTC (Cu, Tear, Curl) type is dominantly produced and there are other types like Orthodox tea, green tea and White tea. To make it simple, there are three main tea grades, generally as whole leaf, broken leaf, fannings and dust. Tea specialists can easily differentiate the Rwandan tea quality and its grades into two categories: primary and secondary tea grades: The primary category includes Broken Pekoe 1 (BP1), Pekoe Fannings1 (PF1), Pekoe Dust (PD) and Dust1 (D1).

The differences between these tea grades are their finest grainy particles as the product from processing full young tea buds when harvested, bruised and allowed to oxidise so that it turns into black tea. The grainy particles have the largest size for Broken Pekoe1 (BP1) and decrease to the smallest size as Dust1 (D1) with thick liquors and aroma. The second category consists of Dust (D), Fannings 1 (F1), Broken Mixed Fannings (BMF) and Broken Mixed Fannings Dust (BMFD). Mostly, the tea particles in the secondary category consist of low-grade tea products with very little trace of black teas and a high percentage of fibres. The top-quality pekoe grades consist of only the leaf buds, which are picked using the balls of fingertips. Fingernails and mechanical tools are not used to avoid bruising (NAEB, 2020).

The Rwandan black tea is appreciated by buyers for the best quality worldwide and it is sold at a competitive price via the Mombasa auctions due to its production in higher altitude areas (87% of tea plantations) where shoot growth rate and accumulation of chemicals is slow compared to the tea from the other Eastern region countries. In the east African Region countries, Kenya is a key connector to the international markets for regional tea offerings from Kenya, Uganda, Tanzania, Rwanda, Burundi, the Democratic Republic of Congo, Malawi, Madagascar, Zambia, and Zimbabwe through Mombasa auctions (Juma, 2019). This makes Kenya leading for tea exports in Africa. The recent report shows that about 97.3% of tea is exported as raw form. Of this, 80% is sold in Mombasa auctions, 17.3% is directly sold to different buyers around the world while only 2.7% is consumed on the domestic market(NAEB, 2021).

The Rwandan made tea is reaching Kenya via Ugandan roads with regional transporters to be sold to the brokers, blenders, and packers or the international firms through Mombasa auctions.

Some tea factories continue making direct exports to different foreign buyers as blenders and or packers who further retail to consumers. These are from the Middle East; Pakistan, United Kingdom, Kazakhstan, Sudan, Egypt, Ireland, and few other countries in the middle East(NAEB, 2021).

2.3. Lending Markets and sources of credits in developing countries

2.3.1. Characteristics of credit markets

Lending mechanisms in developing countries have some common characteristics that no research has ever refuted. Some of these characteristics are frequently discussed in the available literature such as the coexistence of mixed lending sources as formal, semi-formal, and informal institutions, a high level of government intervention, high transactions costs for informal sources, information constraints about credit use, and asymmetric information between a borrower and a lender and, the growing linkage between rural and agricultural population. Overall review of these important features of credit markets is likely to help understand the expected output of supplied credits.

The lending sector in developing nations is generally shared between formal, semi-formal, and informal credit markets. The coexistence of these markets is very old and the interest rate differs greatly in these three markets(Boucher *et al.*, 2009; Kofarmata *et al.*, 2016). Formal credit markets are also called institutional sources to indicate commercial banks, government loans, co-operatives banks. Their share of total credit has grown over time in developing nations but still not predominant in the agriculture sector and for rural communities (Karaivanov & Kessler, 2018). Informal sources or non-institutional sources comprise professional and private moneylenders, cooperative societies, traders, agro-input dealers, friends and relatives within families, etc. Sometimes, semi-formal sources, as described by Andah and Steel (2003), can operate between formal and informal institutional sources, and they are not controlled by the central monetary entity. However, the overall lending activities for these institutions remain the same by issuing debts to borrowers, raising cash, and securing people for smooth consumption as their income can fluctuate by losing jobs, failure of agricultural returns, and general household living and emergency expenses(Kadri *et al.*, 2013).

Imperfect information and high transaction costs are among other characteristics of lending institutions in particular when rural communities pursue financial services compared to urban

people (Karaivanov & Kessler, 2018). The paradigm of imperfect information about clients and lending activities was revealed as a fundamental factor of the coexistence of mixed credit sources as explained by Stiglitz and Hoff (1990). For instance, Kofarmata *et al.* (2016) reported that imperfect information is much more and drives the weakened power of formal lending sources to monitor what is done by a loan that is put into projects. However, the situation slightly differs from informal lending sources as these can access keen information of business capacity and attitudes about borrowers which may increase trust for repayment. The advantage of this last is that they are more community-based than formal lending sources (Stiglitz & Hoff, 1990). Similarly, Khoi *et al.* (2013) argued that informal markets continue to dominate with high share of total lending for poor and low-income families who are often limited to access formal credit because they lack required collateral, so cannot borrow on the basis of their income.

The coexistence of informal and formal markets is also characterised by asymmetric information among players in the credit markets. The fact is that the formal sector can only release credit upon presentation of a valued asset as collateral while it may be an option for informal lenders. The study of Ijioma and Osondu (2015) maintained that this routine lending procedure of asking for collateral instead of estimating observable risks for each presented project is another discouraging factor for credit seekers to borrow from formal lending institutions. Worse still, borrowing people could be found in the situation of losing their assets in the case of non-performing loans yet failed businesses are of various causes.

2.3.2. Rural credits and lending mechanisms

An important number of the population is living in rural areas (World Bank, 2019). Likewise, demand and utilisation of credits for the rural population whose main activity is agriculture has been frequently a basis of discussions for researchers to explain the played role of the rural credit markets and their performance for the sustainable livelihood of rural people. This can also get good insights for formal lending institutions and decision-makers to reduce the gap in financial services between cities and rural areas.

Limited information about borrowers has led to complications for monitoring clients in particular poor and low-income borrowers which demand incentive to take on more risky projects even if these people have a lower expected rate of return (Maurer *et al.*, 2000). In contrast to other sectors (services and industry), lending institutions provide the reason for

discriminating against small-scale agriculturalists. Otherwise, they request collateral assets though some commercial banks may not want them because they are hard to sell in case of default(Maurer *et al.*, 2000). The situation remains in the research debates even if some governments have tried to put in place specialised agricultural lending mechanisms (Stone *et al.*, 2011).

To fill the gap, the informal sector has been always playing a backup to provide credits in particular for rural agricultural people. For instance, money lenders with perfect personal knowledge (better information) of credit seekers may be willing to accept any form of collateral as land or labour. This means that borrowing still works even in absence of collateral in the form of physical asset. This is because of structure and dynamics in informal sources that do not exclude relationships, community-based networks, and other cultural and social shared values between borrowers and lenders. Another advantage is that information about repayment ability, integrity, and types of risk associated with the project on the side of the borrower is smoothly shared between a lender and a borrower, which is not the case in formal lending institutions (Haugen, 2006).

Given asymmetric information between lenders and borrowers, the agricultural population in developing countries will continue to depend on credits in the forms of fixed capital for starting or expanding agricultural business along value chains, working capital for improving farm productivity; so as purchasing farm inputs, etc. Furthermore, as Liu *et al.* (2015) puts it, consumption credits like health insurance, schooling children, and smooth growing for living household standards will also remain among the reasons for borrowing in the formal sector because the informal sector alone cannot meet the needed liquidity for large expenses.

2.4. Credit use in Rwanda and Agriculture sector

2.4.1. Lending institutions

Similar to most developing countries, institutions in the formal sector are regulated by the central bank. The National Bank of Rwanda (NBR) governs the formal institutions of lending in Rwanda through an act of law. The formal sector sector is dominated by local and or regional private-owned commercial banks. Under this category, a list of eleven (11) licensed commercial banks, one (1) Development Bank of Rwanda (DBR), and one (1) Cooperative Bank (Zigama CSS) operate on the Rwandan financial market (NBR, 2017). The formal sector

includes Microfinance institutions in three categories: the first category of 22 are the public limited companies, the second comprises 416 Umurenge SACCOs and the last are the 22 non-Umurenge SACCOs (NBR, 2017). The last two categories are different. Umurenge SACCO is a Rwandan based savings and credit co-operative established in 2008 at the sector level[7]. These are government-based initiatives to boost up rural savings and loans whereas non-Umurenge SACCOs are privately-owned organisations but follow the same approach.

On the other hand, the informal lending mechanism in Rwanda is not a new concept, as it was started as credit unions in the years from the 1970s purposively to mobilise rural savings. Members of informal landing institutions grew consistently since 1970s (Huppi & Feder, 1990). Currently, the informal sector mostly comprises community-based organisations to save and borrow money. These are private moneylenders, tontines of the form of Rotating Savings and Credit Associations (ROSCA). In addition, community based-organisations include farmers-based cooperatives, friends, and family relatives. The difference is that formal lending institutions depend on private deposits while informal ones rely on their capitals (Augustin, 2012). This last is working in the very smallest radial of areas where participants know each other with more trust and mostly they carry out common activities with similar interests (Wivine, 2012).

The development of credit institutions in Rwanda is a result of a long government initiative since 2012. The initiatives started with "creating a financial services centre in Rwanda" and "Rural and agricultural financial services" strategies to lessen the financial services gap between urban and rural areas and the financial inclusion gap in the agriculture value chains respectively(MINECOFIN, 2013; Stone *et al.*, 2011). From then, the total population served for financial services increased from 26% in 2016 to 36% in 2020 mainly because commercial banks banks have extended their services to non-cities and at the provincial level. Microfinance institutions also increased financial services from 65% to 75% in the same period (NISR, 2020a). The introduction of friendly use technologies like Mobile Money (MoMo) and Automatic Teller Machines (ATMs) were also behind the observed changes in the financial sector.

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[7] Umurenge (Kinyarwanda) or Sector (English) is the 3rd level administrative subdivision in Rwanda from down- top

On the other hand, the informal sector has had an increasing share of the total in financial transactions and services uptake from 72% in 2016 to 78% in 2020. The report on financial inclusion (Figure 2.7) showed that the population who use formal sector, use also informal financial arrangements up to 81% in 2020 from 76% in 2016 (IPAR & AFR, 2018; NISR, 2020a).
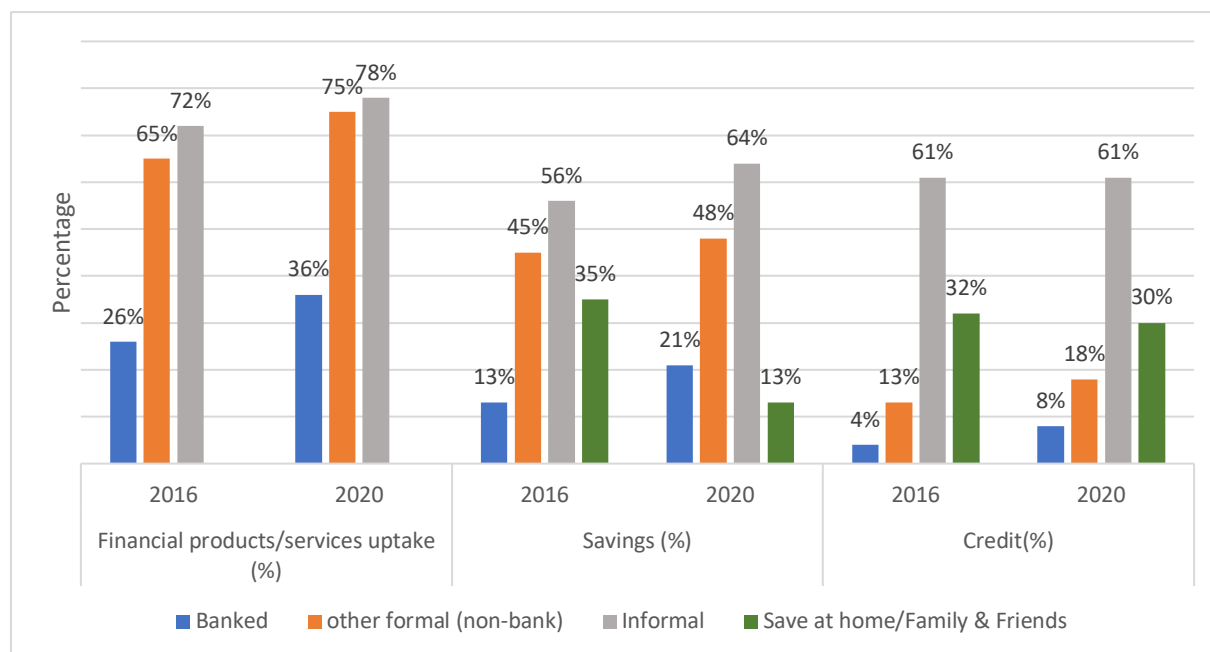
Figure 2.7 Rwanda Financial Inclusion change (2016-2020)

Source: National Institute of Statistics of Rwanda- Financial inclusion survey 2020

Likewise, the informal sector had a higher share of the total savings during the aforementioned period from 56% to 64% respectively however, its share for credits was maintained. Over the same period, the non-banks followed with an increasing trend for both savings and credits between 2016 and 2020 (NISR, 2018b).
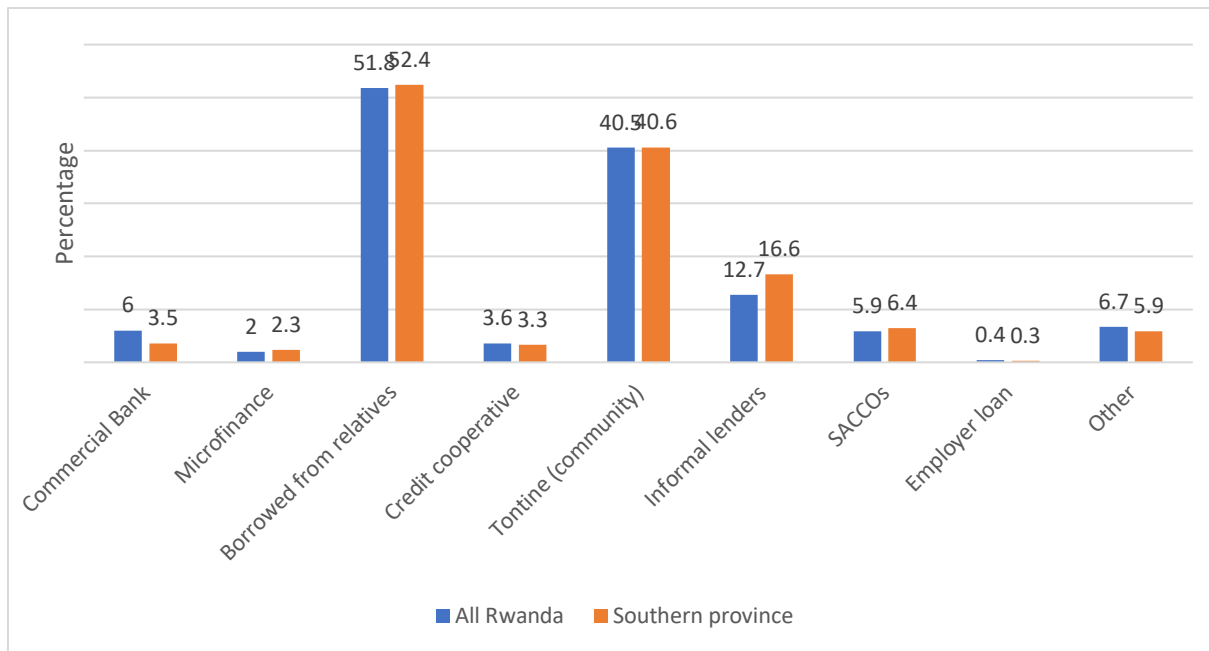
Figure 2.8 Source of credit for households 2016/2017

Source: NISR (2017)

The southern province for this study has followed the national borrowing trend. Informal lending sources have maintained a high share of the total credits granted to households (Figure 2.8). Details of the fifth integrated household living survey (ECIV5) showed that households had utilised friendship and community-based organisations followed by informal lenders for accessing credits with 52.4%, 40.6%, and 16.6% respectively. The aggregated percentage of borrowing reasons for agricultural projects represented 31.5% followed by household expenses with 22.9% in the Southern Province of Rwanda(NISR, 2018b).

2.4.2. Types of credit and associated challenges

The rule of thumb to distinguish types of financing mechanisms is the source of funds. The Institute of Policy Analysis and Research (IPAR-Rwanda) and Access to Finance Rwanda (AFR) in 2018 distinguished three Agricultural financing mechanisms that exist in Rwanda. There is chain liquidity, agricultural finance and value chain finance(IPAR & AFR, 2018). The chain liquidity involves transactions between chain actors where buyers or traders issue short-term credit to producers, which will be paid upon selling their produce. This model is the low-cost finance type as it relies heavily on trust and sharing of almost perfect information regarding the repayment capacity of borrowers. In most cases, there are no direct interest charges to the borrowers and it handles only small sizes of loans, however, critics argued that it creates

dependency and may get farmers into a trap that ends with a vicious cycle of indebtedness. This type of lending is mostly used by input dealers and traders in the tea sector.

Agricultural finance is another type through which formal institutions as banks, Microfinance (MFIs) and SACCOs provide financial services to the borrowers. Usually, the credit is for purchasing farm inputs and other costs for the course of crop production, however; it suffers from all the well-known problems of small–scale rural finance including asymmetry of information, a collateral asset, etc. Development Bank of Rwanda uses this type to give credits to tea farmers through their respective cooperatives.

The last mechanism that consists of combining chain liquidity and agricultural finance is the value chains finance. This last is like when traders access to credit for paying farmers for the crop that is taken to a processor on condition that a processor will pay to a trader through the same bank and bank account. The set conditional lending gives the right the lending institution to deduct the principal amount, and what is due for the interest and charges on the credit, and a trader gets the balance. It is preferred by some donors to strengthen a diverse range of capacity-building initiatives but on the other side, it does not provide a solution for other technical, governance and managerial capacity issues along value chains.

On top of the available financing mechanisms, the government of Rwanda and its partner donors have been linked up to increasing funds in the agriculture sector through input subsidy programs, guarantees and funds depending on stages of specific and well-organised crop value chains (MINAGRI, 2018b; MINICOM, 2015). Good and well that the overall agricultural credit portfolio has been increased at the national level. The share of total national loans has increased within agricultural production from 43% to 51 % from 2012 to 2016 (Nair *et al.*, 2018). However, the formal financial sector is still reluctant to participate in the process of unlocking investment in primary production and generally, its share remains low. It has provided 1.6% against 15% from the informal sector in 2016 (BNR, 2017).

The raised challenges include low control about the causes of non-performing loans (NPLs) observed in the agriculture sector compared with other economic sectors; services and industry (Pham & Lensink, 2007). Others include credits diversion cases by borrowers, lack of managerial skills among farmers who are merely producing for substance (Mpirwa *et al.*, 2018). Furthermore, commercial banks do not want to deal with small-scale farmers | borrowers

on their own and within the agriculture sector context where investment return varies in uncertain conditions.

Last but not least, the purpose of borrowing also drives in screening the credit applicants which is interpreted differently by lenders from their project risks of defaulting (Conning & Udry, 2007; Pham & Lensink, 2007). In this way, farmers obtain credit upon complying with a set of requirements and conditions by formal banks such as possession of financial security and repayment modalities irrespective of particular challenges of the sector.

2.5.Credit in Rwandan tea value chain

In Rwanda, tea production is amongst well-organised export crop value chains where buyers, in particular, provide technical assistance, inputs and credit to tea growers to keep long term secured business relations (Nair *et al.*, 2018). The sector has two main stages along its value chain which determine financial products on one side and the purpose of borrowing by chain actors. The production of green tea leaves falls in the first category and mostly under the control of smallholder farmers and tea cooperatives whereas production of "made tea" from processing green leaves is carried out by tea factories that are privately-owned companies. The tea sector was among the targeted crop value chains from 2012 throughout the implementation of the agricultural financial services strategy (Stone *et al.*, 2011). One of the strategic implementation approaches was the tea expansion program launched in 2012 in the South-West regions to increase the number of tea factories in the newly expanding areas while increasing the rate of input fertilisers application to improved tea production and volume of green tea leaves that are always in shortage for tea processing factories' demand. Mobilising farmers to joining cooperatives was among key priorities for the program so that they can collectively release lands for expanding new tea plantations and installing nurseries for high yielding tea cultivars multiplication and for them to be able to access subsidised input fertilisers and credits. This is behind the increased credits for tea production (Figure 2.9).
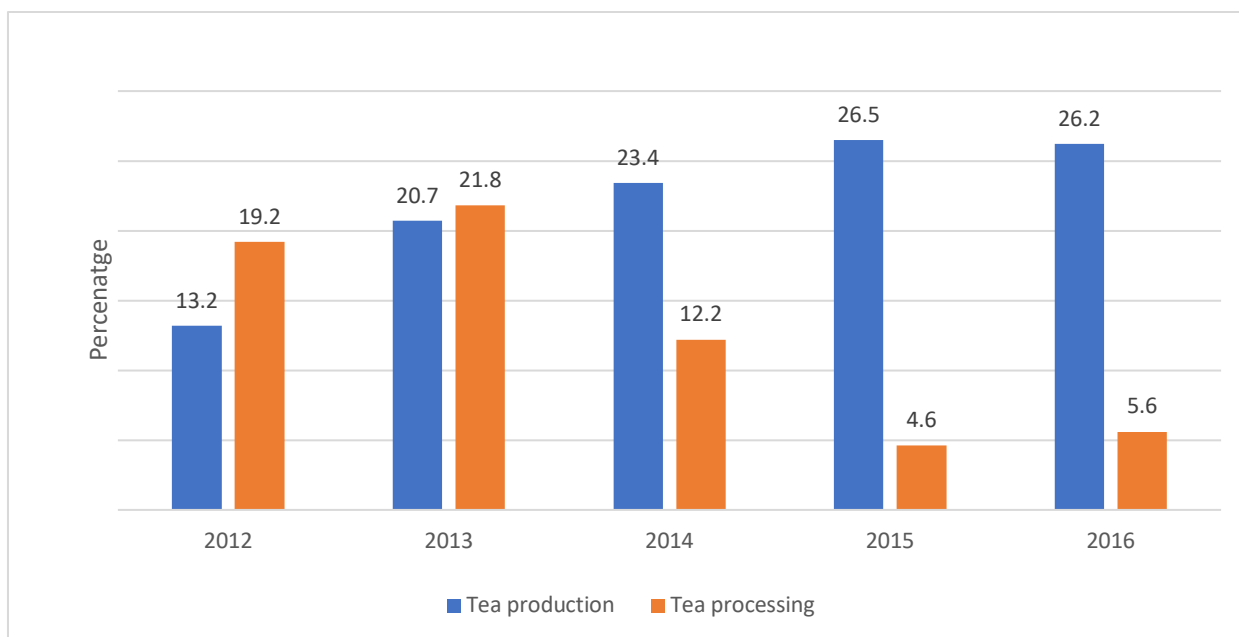
Figure 2.9 Tea share (percentage) in total agriculture credits

Source: BNR (2017)

The collective responsibilities of farmers in cooperatives allow them to borrow important and long-term credits on the behalf of members. The approved credits are managed at a cooperative level after they are distributed to individual farmers in cash for them to meet farm inputs and costs in their farm operations. As result, the Development Bank of Rwanda alone disbursed 22% of the total tea loans portfolio by 2016 to support the production stage and 21% was paid for processing factories(Nair *et al.*, 2018). Besides, tea farmers could borrow from other available credit sources on their own. Over the period from 2012 (the year of starting the tea expansion program) to 2016, the total credit approved for the tea sector has increased constantly from 13.2% to 26.2% respectively. The share has decreased for tea processing projects from 19.2% to 5.6% over the same period because the investment for installing tea processing factories was high and once in the first years of the program. Furthermore, individual tea farmers and through their respective tea cooperatives could procure inputs as credit through the government input subsidy program (MINAGRI, 2012).

2.4.3. Factors influencing credit utilisation

Undoubtedly, credit has been considered as another type of factor to improving agricultural production and farm returns, as it helps in acquiring farm resources and modern technologies for farmers (Kuwornu *et al.*, 2012). For many authors, the role of credit utilisation for agricultural families to improve productivity and overall living standards in the intervention

areas is unquestionable(Diagne & Zeller, 2001; Khodke *et al.*, 2010; Kuwornu *et al.*, 2012; Muhongayire *et al.*, 2013).

In the general scholar findings, the credit utilisation has been viewed with low spectrum to evaluate the influence on the return and demand factors. However, to understand the concept of credit utilisation requires also to first define this concept which requires to stand in the position after having access to certain credited amount to credit cards of credit scores or credit to personal account (traditionally referred to a bank account) in the names of an account owner. The credit utilisation to simply mean how one is deciding to spend the credited amount among needs. Aside of this context, scholars use to calculate credit utilisation rate or credit utilisation rate within credit scoring models as a percentage of available total debt over the total available credit. For instance, a low credit utilisation rate will mean the les using of available amount (one's is far from overspending) and high credit utilisation vice versa.

Despite the challenges raised in the literature about agricultural credit, its availability, accessibility, and affordability for a smallholder farmer whose limited financial security, so cannot borrow on his or her income; credit utilisation and performance have been also considered and taking a place for screening applicants by lending institutions (Oboh & Kushwaha, 2009). In the view of lending institutions, credit utilisation has a sole explanation that approved credit should be strictly used for what it is supposed to be utilised for by a borrower. Otherwise, there would expect a further investigation on loan performance and to justify the results by responding to some questions why credit was utilised for this purpose and not for that another project especially in particular and suspected situation of non-performing loans.

The advanced reasons by lending institutions to restrict borrowers for strictly utilising the approved credits to the presented and evaluated projects are understood as the impact of credit can be undermined by diverting credits to other uses which creates a burden for credit repayment and recovery. For the same purpose, lending institutions exclusively insist that agricultural credit should be used strictly for acquiring farm resources and agricultural inputs such as fertilisers, seeds, equipment, and farm labour. Any other misuse of credit to off-farm operations, in this context it is interpreted as credit diversion(Kuwornu *et al.*, 2012). For instance, around 38% was diverted from coffee to other uses including schooling fees in Kenya (Kamakia, 2016), and 43 % diverted for non-farm activities in Nigeria (Oboh & Kushwaha,

2009). In Rwanda, out of around 475 million Rwandan francs accessed from the Development Bank of Rwanda (BRD) as a credit to tea cooperatives for tea expansion projects, only around 64.8 million representing 13.6 % was used for purchasing fertiliser inputs and land preparation (NAEB, 2013).

Studies revealed that utilising credit among farmers has been determined by various and mixed factors that collude for the interests of both parties from both sides: borrowers and lenders. In different studies, socio-economic factors were frequently mentioned to determine the borrowing decision and purpose that drives the utilisation of received credit (Hussan, 2012), choice of credit source (Liu *et al.*, 2015), the size of credit(Oboh & Kushwaha, 2009) and generally purpose of the credit utilisation (Kamakia, 2016; Kuwornu *et al.*, 2012). The research of Joyce *et al.* (2015) indicated the ability of smallholder farmers to access amount of credit had required both farm and non-farm income capacity level, farm size, availability of family labour, size and ownership of land, savings and repayment ability of a borrower. In terms of credit utilisation, factors of credit utilisation such as the age of a borrower, level of education of household head, income, time as when receiving credit, loan size, farm size and visits of financial officials, extension contacts and mass media were highlighted in various studies to influence the farmers' behaviour for effective credit utilisation in Sub-Sahara African areas(Gana *et al.*, 2009; Khodke *et al.*, 2010; Olofinsao *et al.*, 2018; Wivine, 2012). Some other related studies have also analysed institutional factors to influence access to access credit and or its utilisation (Sossou *et al.*, 2014).

In some context, scholars indicated that extension contact, and farmer based-organisation membership were important to increase the chance for farmers to access credit (Dzadze *et al.*, 2012; Nimoh *et al.*, 2011). In some other contexts, different studies have revealed that the credit defaulting among farmers was significantly attributed to the age, credit constrained, credit disbursement time, size of household, absence of extension services, weak follow-up mechanisms of lending institutions, weak farmers' associations and related management skills to list few(Hussan, 2012; Kamakia, 2016; Kuwornu *et al.*, 2012; Oboh & Kushwaha, 2009). Furthermore, in the study by James obara (2020) on credit utilisation by revealing that is an important aspect, he argued a positive relationship between the unrestricted credit but with strict supervision of agent from lending institution and effective use of credit. This also had a positive relationship between tre-training and effectiveness of credit use.

2.5. Empirical models: description and considerations

In the non-exhaustive literature on empirical studies, individual authors did apply econometric models based on various developed theories but the analytical capacity of the model to provide consistent and reliable estimates is of common reasons (Greene, 2002). In accordance with the current review, various empirical models have been widely used to evaluate responsible factors influencing credit utilisation decisions among farmers within agricultural value chains in different regions, in particular, Sub-Sahara and developing countries.

For the sake of this study interests and buying experience from hitherto studies about agricultural credit and its utilisation, this section talks only about selected and utilised econometric models in this study. Overall, previously utilisation of the currently employed models, the intention of the authors in various contexts in financing agricultural value chains, has been on the responsible factors influencing access and eligibility to credit products from different lending sources such as formal, semi-formal or informal sectors(Ali *et al.*, 2014; Wivine, 2012). Some others' conceptual frameworks have been also aimed at revealing determinants influencing farmers' decisions towards credit utilisation and marginal effects on farm returns (Danso-Abbeam *et al.*, 2016; Kuwornu *et al.*, 2012; Oboh & Ekpebu, 2011; Sossou *et al.*, 2014). Some other studies have tried to link the influence of lending mechanisms and credit utilisation among participants (Deborah *et al.*, 2017; Ilavbarhe & Imoudu, 2013; Isitor *et al.*, 2014; Yusuf *et al.*, 2015).

In the line with the aforementioned literature, a multivariate model has been developed for econometric studies to regress simultaneously multiple binary outcome equations. A multivariate has a general and simple meaning as "many variables" however, its specific meaning is referred to as the many "dependent variables (DV)". This model was to complement the more usually known as statistical procedures that have been used to handle only one dependent variable (DV) at a time such as the t-test, analysis of variance, or chi-squared test (Stevens, 1980). An important number of empirical studies have been also used the multivariate model because of its capacity to account for claimed limitations of its substitute models like univariate, bivariate and multinomial binomial models for discrete choice outcomes in the dependent variable(Cappellari & Jenkins, 2003; Lee, 1977).

Although the true extent of its advantage in estimating the equations with binomial outcomes in the dependent variable is not yet widely understood by the readers and some junior

researchers(Amemiya, 1984; Velandia *et al.*, 2009), the model allows scholars to explore non-exclusive choices within a set of alternatives in presence of factors(Adjognon *et al.*, 2016; Fletschner, 2008; Ma-Azu Abdul-Jalil, 2015; Stephens & Barrett, 2009; Velandia *et al.*, 2009; Wu & Babcock, 1998; Yuan & Gao, 2012). It is preferred over multinomial binomial models because of its capacity to account for non-exclusive outcomes in the dependent variable.

For instance, Velandia *et al.* (2009) used it to evaluate factors influencing the adoption of agricultural risk management. The risk management were of three categories: spreading sales, forward contracting and crop insurance. The model helped to account for non-exclusive or combination of strategies for risk management in the dependent variable. The findings showed that owned land size, non-farm income, age, education and risks connected with business were most determinants for risk management adoption.

Similarly, a multivariate model was used to evaluate factors influencing the choice of appropriate honey market outlets among honey producers in Chena. The factors such as the quantity of honey sold, distance to the nearest market, trust in buyers, membership in cooperative, market information, experience in beekeeping, receiving extension service influenced the decision of honey producers to choose among available market outlets(Tarekegn *et al.*, 2017). The same model was also used to investigate how farmers choose between borrowing from formal, semi-formal and informal sources and responsible factors (Gao, 2012). With a similar philosophy, a multivariate model has been considered for this study to account for non-exclusive choices among categorical credit sources as formal, informal or their combination. For each lending source, a respondent was asked to indicate whether he or she had accessed a tea credit for the first objective being detailed in the chapter three.
According to Streiner (1993) from his comparative study between multivariate and multinomial models, it should be also noted that the multivariate model comes with costs, such as increasing the sophistication of the analysis, which can reduce its power by allowing several ways to answer the same question. However, the model has been praised for its ability to see correlations between variables that would otherwise be missed by using simpler and univariate procedures.

This study has also employed a fractional logit model suggested by Papke and Wooldridge (2008) for quantitative studies with percentage, rates and continuous data that are naturally limited within one unit of interval for the dependent variable. The fractional logit model has

other advantages of integrating non-linear probit and logit models while restricting the mean conditions of the dependent variable on independent variables. Besides, parameters of the fractional model are estimated using the quasi-maximum likelihood method (QML) estimator as well as under general linear model conditions (Gallani & Krishnan, 2015). Therefore, the model is suitable for the present study that has indexed credit utilisation as a continuous dependent variable expressed as the percentage of amount out of total accessed credit that was utilised for tea production projects by tea farmers. The model is assumed too much perfect in estimating marginal effects of individual regressors as factors influencing tea farmers' decision to utilise accessed credit for tea production purpose.

The study should consider the oldest Tobit model (Tobin, 1958)that has been popular for types of studies with corner solutions at both 0 and 1 limits to estimate fractional dependent variables. However, similar to Non-Linear Squares (NLS) models, the Tobit model was found to have some limitations. It was recently challenged to yield inconsistent estimates from its normality assumption of the error distribution (Arabmazar & Schmidt, 1981). Furthermore, the Tobit unable to appropriately capture observations in their natural fractional values for the dependent variable as its analysis involves the transformation of data from its natural observations to truncated and censored data by Gallani and Wooldridge (2015) and Wooldridge (2002). To overcome the raised difficulties in regressing continuous cross-sectional observations for the dependent variable, the fractional logit model was used for analysis in chapter four.

This study has also considered the Endogenous Switching Regression (ESR) model for its advantage in studying mutual exclusive regimes most likely when evaluating the impact of specific interventions. The model has the advantage of account for endogeneity error by regressing simultaneously selection and treatment equations of two categories using Full Information Maximum likelihood (FIML) just in one command as suggested by Lokshin and Sajaia (2004).

This model has been used frequently in empirical studies and in agriculture as well to evaluate the effects of specific interventions as credits participation, programs or projects under defined conditions(Ali *et al.*, 2014; Awotide *et al.*, 2015; Feder *et al.*, 1990; Freeman *et al.*, 1998; K. O. Fuglie & Bosch, 1995; Manyong, 2007; Tilahun, 2015). For instance, the model was used to analyse the effect of employed credit to increase crossbred dairy cows and production in east African highlands. The study had segmented farmers into credit constrained and non-constrained groups. Findings showed no consistent relationship between credit constraint

condition and the borrowing status (Freeman *et al.*, 1998). The ESR model was also used to evaluate the difference in farm productivity between endowments among credit constrained and non-constrained households (Guirkinger & Boucher, 2008) to evaluate the difference in productivity among farmers' groups. Similarly, ESR was used in Rwanda to test the effect of credit on agricultural productivity between constrained and non-constrained households in semi-formal credit markets. The study revealed that constrained households gave up participating in off-farm self-employment by 6.3 % and substituted by low-income employment in the farms as farm labour.

Similarly, the ESR was considered for this study for estimating the effect of utilised credit on tea farm income as an index of produced and supplied green tea leaves to factories by tea farmers in the Nyaruguru district of Southern Province of Rwanda for chapter five. Finally, the analytical framework for the selected variables and the analytical capacity of each model is further discussed separately from chapter three to chapter five of this thesis.

2.6. Theoretical framework

This research is built on two main theories: expense-preference behaviour theory and utility theory. These two were built to explain how spending or investment decision is valid based on utility maximisation as opposite to the profit maximisation and the assumption is on how one is rational for any outcome from the decision made between alternative options.

2.6.1. Expense-preference behaviour theory

The theory of expense-preference behaviour theory was mostly employed in the research. Both Williamson and Rees have contributed to the theory that posits on individual preferences that maximise utilities of firms' managers through the pursuing of non-maximisation rules(Rees, 1974; Williamson, 1963). In its narrow working form, the expense preference theory posits that businesses will increase more additional unit of input (say labour) than envisioned profit maximisation behaviour, other factors held constant. Following this reasoning, the assumption predicts that under the separation of factors is that tea farmers try to choose the investment for credited amount more on other prerequisites to maximise the utility objective that depends on the inputs supplied for tea production than is consistent with profit maximisation.

The theoretical framework on financial institutions was evaluated by using historical recorded data for more than 40 banks in different periods (1962, 1964 and 1986) where dictating variables as wages and salaries would determine rate of employability(Gropper & Oswald, 1996; Hannan, 1979). The findings got to conclude that expense behaviour was significant force that detracts the profitability in many banks. Other studies (Amould, 1985; Barus *et al.*, 2017) came to the same conclusion that measuring performance validated the profitability of money lenders as reduced or increased depending on the expense behaviour of credit users. This theory is employed for this research to explain the preferential decision of tea farmers for alternative investment options, either to spend total amount of received credit for the primarily presented projects in tea production or alternative choices here means credit diversion. This theory is relevant for the first and second objectives of these thesis to understand the assumptions of the empirical methods employed for regressions.

2.6.2. Utility theory

The present study on tea credit utilisation factors among tea farmer households. The study refers to sustainable rural households models within the agricultural household models (Taylor & Adelman, 2003)and mostly these models were developed to capture the double role played by a household farmer who always stands as a "producer" and a "buyer or simply consumer". Trying to include this double role while developing assumptions for empirical models employed by researchers, a farmer household is assumed to be always rational for any taken decision within a household model that based on the expected utility for any made choice. The present study has extended the approach of doing analysis to simply reaching the choice of exogenous factors that drive the farmer's decision hence this literature focuses on the widen theory known as the "Expected utility theory"(Taylor & Adelman, 2003)to explain an individual decision against expected utility (Fishburn, 1970). The expected utility theory is commonly recognised as a normative model of rational choice.

The utility theory is a powerful tool for the analysis of decision under risk and was conceptualised by economists and philosophers to normalise status of the expected theory(Karni & Zhou, 2021; Małecka, 2020). This expected utility theory has been known as individual behaviour. The violations from predictions of simple expected utility models were criticised until 1970s when a variety of alternatives to, and generalisations of, expected utility begun to appear like prospect theory by Kahneman and Tversky (1979). Afterwards, from the expected utility fundamentals were customised and employed in the research by scholars to

explain status of the expected utility theory within different context as complete and incomplete choices among alternative options.

The theory was however criticised in various studies as an adequate descriptive model of human behaviour and to have limitations when applied for incomplete outcomes with or without mutual exclusivity choices(Levy *et al.*, 2000) . For instance, in the experimental study of Kahneman and Tversky (1979) on the choice under uncertainty, authors questioned that developers of the expected utility theory did not consider the implications of making decisions with full terminal impact. Decisions made grounded on transformation in wealth have different utility implications if they are made on terminal wealth. In expected utility theory, scholars are much risk averse when considering prospects with only expected negative outcomes and in addition, they systematically misrepresent probabilities by advancing subjective probabilities rather than objective probabilities. Therefore, depending on its conceptualisation and assumptions, this influences the adoption of empirical model to employ for and within the context which brought research debate and development of assumption to explain status of expected utility theory. The current context considered all challenges and limitations and has also considered the Agricultural household model to recognise the interlinked characteristics of the consumption and production decisions of a farmer depending on the markets that is explained below.

2.6.3. Agricultural household theory

The agricultural household theory is also important for the current study to recognise the jointly decisions by small farmers who play a double role as a producer but also at the same time as a consumer. The theory has brought in the expenditure equations the concept of factor demand of off-farm inputs supply like labour(Arthur & van Kooten, 1985). The theory highlights that if the allocation of the inputs between on farm and off farm are separately treated in the clear manner, then it is possible to discuss a farmer household's consumption and production decisions with a minimum set of assumptions(Huffman, 1980). The current study considers how a farmer's decisions are influenced for allocating limited resources. i.e., accessed credit amount among farm needs refers here as inputs. A farmer household theory valid the accommodation the situation that he or she makes a choice of what to invest in based on the expected utility to of course minimising the risk under certain conditions. This has guided the construction and modelling the allocation decision between tea farm and non-farm investment decision by a farmer as developed for the second objective of this thesis.

2.6.4. Theories' assumption

As aforementioned above, the agricultural household model distinguishes a household tea farmer as being involved in dual roles; both as a producer (agricultural products) and a consumer (of both purchased and own-produced goods). But also, it is fundamental to explain how farmers are rationally deciding for maximising utility subject to constraint budget. It also helps to differentiate a household farmer from any other pure consumer.

In this view, an agricultural household farmer is a producer and at the same time he is a pure consumer. Therefore, he has to be understood due to that in the last, the household living budget is generally assumed to be fixed, whereas in the household-farm model it is endogenous and depends on production decision that contributes to income through farm profits (Taylor & Adelman, 2003). In the framework analysis, Scoones (1998) showed the linkage between the five key indicators such as natural, economic, human, social and capitals for achieving sustainable livelihoods. The natural and social attributes should not be ignored as they determine the access to living standards such as food and enjoy good health. Understanding them help readers and researchers to explain how constraint capitals are utilised among alternative uses by people to survive (Ellis, 2000; Li *et al.*, 2021).

In the studies on the application of sustainable rural livelihoods theories, researchers tried to explain and demonstrate the existence of a real-valued utility function the so-called "expected overall utility" to be maximised by a rural household by adopting principles of rational choice from alternatives under constrained resources (Li *et al.*, 2021; Mazziotta & Pareto, 2014).

The expected utility function for a rural household farmer derives from classical positive theories in the sense of providing explanations for made decisions and conclude about the choice preferences from the observed behaviour of people under investigation (Coleman *et al.*, 1992).The underpinning utility theory deals with the rational behaviour of one or more individual decision-making units (Green, 2002). Thereafter the utility theory has been widely applied in various studies using its mathematical formulation as utility function to rank one' s preferences in terms of satisfaction and to describe how the decision is made throughout choosing between consumption bundles (Coleman *et al.*, 1992) This gave a foundation for this study to develop an analytical framework by assuming that utilisation of credit for tea

production or diverting to nonfarm uses resides from the latent expected utility as a proxy of the degree of household's satisfaction from the project realised.

Following the same reasoning, the farmer's decision towards credit utilisation is assumed guided by the latent expected utility. The utilities may also be driven by different factors that are further explored throughout the discussions of the thesis. To make it easy for readers, if the difference between expected utilities (U) from credit utilised among competing alternative uses is positive (U>0), then a farmer is better off for a decision made. Likewise, tea farmers are assumed to be rational for any decision made that by utilising credits amongst alternatives the expected utility say tea farm income should always be higher than any other alternative use.

Mathematically, the expected utility (EU) of household tea farmer i by utilising credit is either for tea production project or off-tea farm uses can be expressed as follows;

$$\begin{cases} EU_{ij} = \beta_j \chi_i + \varepsilon_{ij} \ for \ tea \ production \ investment \\ EU_{ik} = \beta_k \chi_i + \varepsilon_{ik} \qquad for \ off-tea \ investment \end{cases} \text{..} (1)$$

where EU_{ij} and EU_{ik} are expected utilities for a household who chooses to utilise the received credit either for tea enterprise or otherwise respectively, and χ is a vector of influencing factors both socio-economic and institutional factors. Each expected utility function can be expressed in the sub-function of utilities depending on the type of made investment. Utility from producing tea EU_{ij} is the aggregated sub utilities (φE_j) from utilising farm inputs, as fertilisers(F_{ert}), expanding area under tea production(L_{and}), high yielding clones(S_d), hiring tea pluckers(L_c), farm equipment (E_p) and extension service fees (E_{xt}) etc. Similarly, expected utility from off-tea investment (EU_{ik}) is the aggregated sub-expected utilities (φE_k) by increasing various economic activities such as the production of other crops(C_{rop}), informal and formal businesses(B_s), Livestock keeping (L_{st}) and household expenses (HH_{exp}) etc. Therefore, Eq.1 can be re-written as follows;

$$\begin{cases} EU_{ij} = \varphi E_j\big(F_{ert}, L_{and}, S_d, L_c, E_p, E_{xt}\big) = \beta_j \chi_i + \varepsilon_{ij} \\ EU_{ik} = \varphi E_k\big(C_{rop}, B_s, L_{st}, HH_{exp}\big) \qquad = \beta_k \chi_i + \varepsilon_{ik} \end{cases} \text{.......................................} (2)$$

The difference between expected utilities from utilising credits is denoted by U and it can be expressed as:

$$EU_{ij} - EU_{ik} = (\beta_j \chi_i + \varepsilon_{ij}) - (\beta_k \chi_i + \varepsilon_{ik}) \text{...} (3)$$

$$U = (EU_{ij} - EU_{ik}) = (\beta_j - \beta_k)\chi_i + (\varepsilon_{ij} - \varepsilon_{ik}) = \beta x_i + \varepsilon_i \text{.............................} (4)$$

Therefore, the sufficiency conditional for utilising credit for tea production is only when a farmer's expected utility is positive. Mathematically it is when $EU_{ij} - EU_{ik} > 0$ or simply when $U = EU_{ij} - EU_{ik} > 0$, other conditions held constant.

2.7. Conceptual framework

The conceptual framework of this study derives from the aforementioned rational choice (Green, 2002) within utility theory (Coto-Millán, 2003). The theoretical section has provided a basis of conceptualising the study framework and selection of potential factors influencing the tea farmers' decision to utilise tea credit in the Nyaruguru District. The selection of factors is guided by existing literature in relation to the evaluation context and dimension.

Tea farmers' choice towards credits sources and borrowing decision derives from the owned financial capacity and desired status. If the difference between possessed and desired investment capacity beyond the normal savings by a tea farmer is negative then he/she will need to look for the external financial source to meet the gap. This one's financial capacity is driven by socio-economic factors. On other hand, the decision of borrowing is also driven by institutional factors that are behind the availability, accessibility, affordability and timely credit that can be approved. Concurrently, the idea for and type of project for which a credit is requested influences the choice of credit sources as well.

The expected utility drives the way of allocating credit accessed among alternative uses. Farmers' decision throughout presented scenarios and conditions is driven by a number of factors. From the literature review about farmers' decision and influencing factors, these were of three categorised as institutional, socio-economic and environmental factors (Divine, 2014; Issa & Chrysostome, 2015; Muhongayire *et al.*, 2013; Mutandwa & Kwiringirimana, 2015). To these categories, Yehuala (2008) has also added communication factor as a function of distance from and to financial lending institutions.
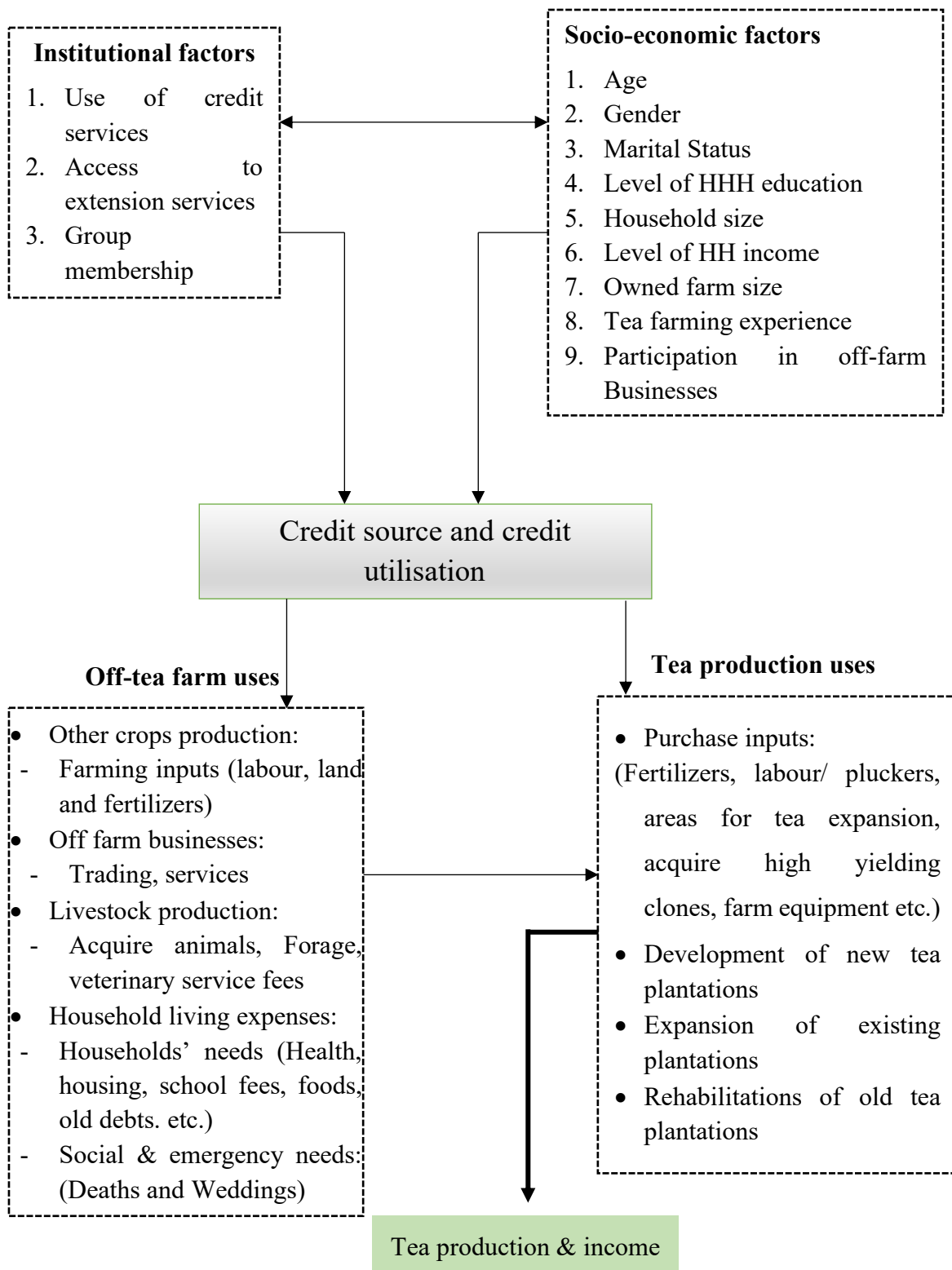
Figure 2.10 Conceptual framework for analysis of the factors influencing credit utilisation

To our best knowledge of the study area, the conceptualised framework for this study has restricted these factors into two categories such as institutional and socio-economic factors (Figure 2.10). These factors are assumed to influence farmers' decision towards end utilisation of tea credits among alternative investment in the study area. Utilisation includes two broad

alternative expenditures as either for tea production projects or off-tea farm projects for example to meet the general household living expenses and or to run off-farm businesses by speculating higher benefits.

Since the core interest of the study evaluation focused on impact of credit utilisation and determinants factors just because approved credits for tea farmers were restricted to intended and presented tea production and related projects in the time of borrowing. Any other credit utilised to either out of off-tea production activities in this context is observed as diverting tea credits. The study's assumption was that the level of income to realise from investing in the project of tea production to increase for instance the quantity of green tea leaves to be supplied to the processing factories when other factors are held constant is positively correlated with the level of investment made by farmers. Determinants being as adjusted the rate of the addition labour input and rate of fertiliser application, improved tea clones with high yielding, operating costs like payment of hired labour for tea plucking etc.

As abovementioned, factors influencing farmers' decisions toward the choosing of credit sources and type of project to invest in are driven by two types of factors: institutional and socio-economic factors. The first category of institutional factors includes the type of availability and use of credit sources, type of extension services and respective service providers and farmers-based membership in the cooperative as a member of tea cooperative. It is also expected that institutional factors play a substantial role in choosing the source of credit and influencing how the accessed credit was further utilised by borrower farmers. For instance, participating in practical training on the Good Agricultural Practices (GAP) for tea production provided through cooperative, monitoring programs through visits conducted by institution officials generally expected to have a positive effect on how credits were utilised. Similarly, the corresponding farm income is expected to be positively and likely improved as participant farmers become efficient in applying technical skills, knowledge and available resources acquired from these extension agents. Likewise, tea cooperative-based membership is likely to allow members to access special credit products like shared credit or group credits, credit in kind as input fertilisers, equipment and after service follow up on how credit is utilised by cooperative leaders all would expect to have a positive effect on the tea farm outputs and income. Also, farmers' decision about credit sources of a tea farmer is expected to be driven by the availability of credit sources, the cost of borrowing and administration procedure, size

of the credit amount desired, period of repayment and time it takes between the date of credit application and date of receiving the approved credit.

The socio-economic factors are also important for tea farmers 'borrowing decisions and credit utilisation. These factors include both tea-farming household and farm characteristics such as the age, gender, marital status and education level of the household head, the household size, income level of the household members, experience in tea farming, the size of owned tea plantations and possession of off businesses. Identified characteristics under this study might not be exhausted but most importantly they are chosen based on how they are supported by the literature and from our knowledge about the study area. On the other hand, both institutional and socio-economic characteristics are expected to influence the credit utilisation either for revealed tea production projects to lenders as it was analysed by lending institutions or for off-tea farm projects as information kept by borrowers. Revealing true information to lenders by borrowing farmers is always assumed to happen, the so called existing asymmetric information between credit players, lenders, and borrowers. To some extent, researchers had revealed that credit performance should not always be attributed to the projects implementation status in particular in similar context of this study areas where farmers can diversify investment or playing double role of producer and consumer. This means, credit performance may result of complying to repayment obligation even if this comes from the alternative sources of income. However, the current study was assuming that tea credits were approved based on the presented project by farmers like purchasing farm inputs, development of new tea plantations, expanding operations, otherwise for rehabilitation of the old tea plantations. Furthermore, credit diversion was also considered in the analysis to like situation when farmers can cheat by utilising tea credits for other off-farm uses like production of other food crops, off-farm rural businesses, living expenses within the households, and social needs etc.

The influence of all these factors on farmers' decisions and expected signed are further detailed throughout the chapters of this thesis that are customised for each specific objective with respective empirical model.

2.8. Operationalisation of variables in the empirical models

There is no theory that strictly dictates type of explanatory variables to be included in the econometric models for empirical studies. Therefore, econometric variables selected for the current empirical models derive from study related theories, reviewed on the similar conducted

empirical studies (deduction) and the knowledge about current situation (induction) and local context in the study area or subject under consideration. Therefore, current research considers factors influencing the utilisation of received credit that were used in related and available studies (Divine, 2014; Issa & Chrysostome, 2015; Muhongayire *et al.*, 2013; Mutandwa & Kwiringirimana, 2015) to explain the situation in current context for tea farmers and tea production in Rwanda. These variables were tested by in the employed empirical models to explain the expected endogenous outcome. For instance, for type for credit sources utilised as dependent variable for the first objective, a household tea farmer could choose one or more source(s) of credit either from formal, informal or combined sources. Similarly, for the second objective to assess end utilisation of received credit with dichotomous outcome; on tea farm or off-tea farm utilisation, he/she could allocate received credit between alternative investment; hence, explanatory variables selected might jointly influence the choice about the borrowing sources among alternatives and the way of utilising credit. The specific variables for each of selected empirical models were presented in the respective chapters and for the selected and respective models. Although, the independent variables are modelled in each chapter this section hypothetically defines the key variables used in the employed models.

Gender variable indexes a sex of the household head who is the implicit key decision-maker for the household in particular toward tea production and viable projects. The variable takes value of one if the household head is male and zero if female. Related studies revealed that if a man is the head of the household, he has more exposure than a female on farming opportunities and he can dominantly take an important decision on investment plan within tea farm enterprise. Carranza *et al.* (2018) and Greene *et al.* (2003) claimed that firm enterprise owned by women is likely less performing on technical efficiency than that owned by a man. This is because of limited access to finance, lack of collateral and women's double duties(Sossou *et al.*, 2014).

Age of household head is also included in the variable because it is believed that younger farmers are risk lovers than elders, in other words more aged more risk averse. In addition, younger household head has motivation, energy and commitment to work and is more inclined to take risks, as elder one is likely to have reached his/her initial aspiration. However, in terms of household structure, age is important indicating the level of consumption and the level of household income, as this last one can be understood that as a greater number of the household members have jobs, they are contributing to the aggregated income of the household. This

means that if they do not have job, the current consumption is higher than the future saving hence low capacity in terms of investment. Similarly, the higher number of dependents, the higher risk of non-loan performing or defaulting due to possibility of diverting credit from intended projects to meet social expenses. In this way, level of income can influence a way of allocating received credit among competing projects.

Marital status of the household head deduces stability in decision making. In this way, married ones are assumed to be stable and focus for investment when deciding on type of investment among alternatives at household's level than non-married ones. Therefore, married ones are assumed to be efficient in tea production as well as efficient in credit utilisation.

The household size is also influencing credit allocation and utilisation. In study area, more a household is able to supply farm labour more investment for hired labour decreases. Therefore, increasing number of younger household members for this variable, less hired number of labours vice versa. Similarly, structure of household status has a crucial meaning in way of utilising credit.

More a household has a greater number of salaried members and able to recoup off-farm income, more household members have less borrowing willingness and or less misallocating of received credit. In this way, positive welfare of households influences the level of need the external funding, rational allocation, increasing level of income and consumption. Thus, whose positive welfare families will need more and better utilisation of credit (Diagne & Zeller, 2001).

Education level of the household head indicates his or her level of learning capacity. Credit utilisation and good agricultural practices are knowledge-intensive based, thus requires ability to understand risks of using credit in uncertain environment and associated risks like in agriculture sector with no price market control. The level of education of household head has been found positively associated with managerial skills from learning process or training he or she has been participated hence his or her literacy skills is higher than those with low or limited formal education level(Barham *et al.*, 1996; Carter & Jones-Evans, 2006). Therefore, higher level of education, more the household head is expected to be efficient in good agricultural practices for tea production and credit utilisation hence high expected income from tea enterprise.

Farm size variable represents only total of land in acres used for tea production and may include both owned and hired land at least in the last three years from 2020. This is because tea credit is requested upon evaluating tea production projects presented by the owner. The analysis of auto repayment farm capacity must be in relative of its production capacity. Therefore, the more size of tea plantation owned, more likely to have approved the desired credit amount for tea production (i.e., less diversion of received credit) and likely to investment and increase income.

Tea farmers' relative experience measures the ratio of years in tea farming as experience to age of the household head. This ratio indicating the involvement of household head in tea farming. Typically, there should be a positive correlation between the age and farming experience for a tea household head in the study area. In this way, higher number of years in tea production should correlate with the efficiency use of available farm resources, high skills in the good agricultural practices, and improved knowledge in credit management for intended tea projects. Therefore, number of years in farming experience generally shows the commitment to likely increase the income from tea production.

Distance variable to access to financial services is a variable that measures a distance in kilometres from and to nearest lending institution and its related costs implicit transportation costs. It is expected that increasing value of this variable has negative relationship to borrow from an institution located to longer distance from the local of the household. Therefore, it's increasing diminishes related marginal utility of borrowers.

Type of credit-received is also a variable (group or individual) that shows the level of willingness to utilise that type of credit product. If the household head had received a group credit through cooperative, is more likely to have utilised for intended projects in tea enterprise than those who got individual credit without cooperative's involvement. This is because a joint credit is collectively managed and monitored within group organisation than independent credits. Therefore, credit diversion is expected to be higher among tea farmers who received individual credits than who received group credit through their respective cooperative.

Credit constraint - it is commonly defined as credit rationing whereby in some circumstances, a borrower could secure credit amount while others who are willing and able to borrow at

prevailing interest rate are unable to secure credit or desired amount under the same conditions. In this way, a tea farmer is constrained if he or she could not borrow desired credit amount to satisfy his or her economic demand like situation where he or she is allowed for less than credit amount he or she had requested for. As result, the level of his or her investment for tea production projects is assumed to have a positive correlation with desired and received credit size. If tea farmers are not constrained, they probably optimise investment with expecting higher return from tea business than constrained farmers. In the model, credit constraint as dummy variable measures two situations either when a household head is being constrained or not unconstrained.

The variable of training measures whether household had participated or not participated in training organised on good agricultural practices for tea production techniques in the study area through their respective cooperatives in the last three years. Having participated in such training would influence the performance of using received credit for tea production through for instance procuring necessary farm inputs in bulk, thus increasing tea farm income and reduces misuse of received credit.

Credit delay variable measures the period between date of credit application and date of receiving credit from lending institution. The longer period has, higher the risk of diverting received credit, as users would need to buy tea farm inputs within a specific period before the starting of the season. Therefore, delayed credit may affect not only the efficiency utilisation of credit but also it negatively affects production and expected tea income in particular when they use input fertilisers received to other crops and or resell to neighbours.

Sources of credit variable measures whether credit user had received credit from informal, formal or both combined sources. The source of credit is important to influence level of commitment and decision to use credit for intended projects of tea production or otherwise among alternative uses. If the source of credit was formal lenders, such commercial banks, MFIs or SACCOs, a borrower is likely to fully utilise the received credit amount for intended projects because of a continuous monitoring by the agents of these lending institutions. And in most of the time, lenders are engaging responsibilities of borrowers by signing strict contracts which may not the case when borrowing from informal lenders. The engagement of the credit participants obliges them to strictly use the received credit amount for intended uses to limit diverting cases and otherwise they risk losing their engaged properties as collaterals.

Extension services by agents of lending institutions play an important role for efficiently utilising received credit. This means diverting of credit is likely limited among credit users when they are linked with extension service providers from lending institutions or when they are participating in organised monitoring sessions and receive related coaching on credit utilisation and credit management. In this way, receiving credit from formal sources is expected to have a positive correlation with the efficiency use of received credit for tea enterprise and income from this business as it opposes when tea farmers borrow from informal sources.

Credit use experience measures the frequency of using credit for tea enterprise by household head whatever the source of credit. The more household indicated more than one in using credit for tea production, the more involvement in tea sector and he/she is expected to be among the best users of tea credit and less diverting ratio, thus increased income from tea businesses.

Access to income from off-tea businesses is a proxy variable to measure the farmers non-tea businesses income. It is indexed as a dummy variable to denote whether or not the credit user had participated in the off-farm tea activities during last three years in the study area. This measures the contribution of these off-farm business on the total household income therefore the credit received is likely diverted to off-tea uses because by tea farmers by expecting high returns from competing businesses and income from tea enterprise is seemingly weighted low.

Tea farm income is the index of gross income as part of total household income and that is the total amount paid to a farmer household by processing tea factories which equivalent to the value of quantities of green tea leaves supplied and from the total tea plantations owned by the household. Therefore, the study has considered that a variable of tea income will only refer to the portion of total tea farm household income obtained from tea production business. This income from tea production by a household may be in cash from selling green tea leaves, selling related services to maintain or improve the production of tea plantations of other farmers or value of the property acquired from tea income such as hired or purchased land, installation of nursery to produce seedlings of high yielding capacity or other assets could be explained by the respondents during survey. In this way, gross income from tea production by a household will be measured in Rwandan francs at the current exchange rate of all generated money plus the value of assets and other investment made from the income generated from tea enterprise.

CHAPTER THREE

FACTORS INFLUENCING TEA FARMERS' DECISIONS TO UTILISE SOURCES OF CREDIT IN NYARUGURU DISTRICT, RWANDA: A Multivariate Probit Regression Analysis

Abstract

Credit is a major tool and an important factor for tea production and farm outcome. Its demand from different lending sources has been increasing to meet capital investment in the tea sector. Accessed credit was to meet costs of tea production mainly fertilisers, seedlings and labour as well. Factors to access to credit has been a subject of vast debate in recent studies that credit seekers obtain credits only when they are eligible by complying with the requirements set by lending institutions. However, the literature has limited findings on the behaviour of small-scale borrowers in selecting a credit source and inducing factors. In particular, borrowing arrangements necessitate the analysis to inform policy makers on needed adjustment in the lending system to improve tea production and sector development. The study aims at disclosing responsible factors to choose a particular credit source by smallholder tea farmers. A survey was conducted on 358 tea growers selected randomly in two cooperatives that operating in the Nyaruguru district. A multivariate probit model was used for analytical analysis. Borrowing from formal source (commercial banks) increased if the borrower possessed collateral asset (85.5%), interest rate (85.0%) size of tea plantation (24.8%) and household composition (10.5%). Using informal sources increased if a farmer desired a small credit (83.2%), participated in technical training (76.9%) received joint credit (46.9%), while a farmer was likely to use less informal sources if his/her farm size (39.9%) and household income (29.2%) were small. However, combining sources of credit was used by farmers as a safeguard strategy to acquire the desired loan. A government policy, which aims to increase productive investment, should emphasise integrating agricultural loans in the financial system targeting smallholder farmers through their organisations where they can relax credit constraints.

Keywords: *Formal source, Informal source, Credit source, credit utilisation, Tea farmers, Nyaruguru, Rwanda*

3.1.Introduction

Tea and coffee are dominant cash crops since the colonial period (the 1930s) in Rwanda. Over the period, the two crops are still leading foreign earnings from agricultural exports(World Bank, 2019). The small-scale tea farmers own 70% of the total tea plantations and processing tea factories' production depends on a daily supply of green tea leaves from these farmers

(World Bank, 2013). Since 2013, the tea expansion program that integrates modern agricultural practices in Rwanda has required farmers to increase the capital to purchase farm inputs in order to meet the national export targets for the sector(MINICOM, 2015). Tea household farmers will need to increase the rate of use fertiliser inputs, rehabilitate the old tea plantations, increasing tea fields acreage and meet the cost for plucking and transportation of produce to the processing factories. As a result, credit is a major tool and an important factor for tea production and farm outcome. Its demand from different lending sources has been increasing to meet capital investment in the tea sector(NAEB, 2013; Papias & Ganesan, 2010).

The report of the national institute of statistics of Rwanda (NISR, 2018) showed that formal, semi-formal and informal sources have provided credit to farmers with 4%, 32.1% and 54.3% respectively (NISR, 2018a). Lending statistics are from available sources in the study area. MINECOFIN (2013)defines formal lending institutions as all regulated commercial and development banks. Semi-formal sources are microfinance banks that fall into four categories, namely informal MFIs, SACCOs with collected deposits of less than 20 million Rwandan francs, limited companies or SACCOs with deposits over 20 million Rwandan francs and non-deposit taking MFIs. Informal sources include farmers' cooperatives, Rotating Savings and Credit Association (ROSCA), inputs suppliers, tontines, private moneylenders, friends and relatives. The latter channelises loans via community networks as they are operating in the very smallest radial of areas where participants know each other with more trust and mostly they carry out common activities with similar interests(Muhongayire *et al.*, 2013). Tea cooperatives fall into the category of informal sources where they provide non-cash credit for members as fertiliser inputs. Credit provided to members must be paid by deducting a certain amount upon supplying green tea leaves to the factories.

perspectives because of lending and borrowing conditions. The lending side is mostly regarded as the availability of lending institutions and their coexistence of being either formal, semi-informal or informal credit markets where interest rate differs greatly in these three markets (Boucher *et al.*, 2009; Kofarmata *et al.*, 2016). Studies argued that the availability of financial institutions and lending system plays an important role for borrowers to decide whether to utilise credit source or not. Factors viz., savings, level of the interest rate charged, possession of the collateral such a house, land or forest plots, previous credit record, level of information displayed for credit products and overall governance issues influence the behaviour of borrowers among smallholder farmers (Deborah *et al.*, 2017; Salami *et al.*, 2013). As opposite

to institutional factors, the borrowing side is widely discussed to explain how socio-economic and farm characteristics of credit applicants the determinants of access to credit for the desired amount(Gemere, 2017; Ijioma & Osondu, 2015; Mgbakor *et al.*, 2014; Oshaji, 2018). Empirical studies synchronously revealed that the financial activities of the household farmers from formal sources are determined by the mobilisation of farmers into groups, off-farm incomes, collateral asset and education (Moahid & Maharjan, 2020; Muhongayire *et al.*, 2013). On another side, lack of collateral asset, inflexibility in repayment arrangement systems, high borrowing costs, problems connected with disbursement time are mostly affecting credit access from formal financial institutions(Gobena & Jembere, 2016). Borrowing from informal sources are determined by mostly agricultural extension, community-based groups, trustful relationship with money lenders, size of credit that is relatively small and short term (Hosseyni *et al.*, 2012).

However, national statistics show a low rate of credit supply for agricultural projects from formal sources where Microfinance institutions including SACCOs supplied about 15% while commercial banks supplied 1.6% in 2016 (BNR, 2017). The figures can be explained by the fact that the agriculture sector has been less attractive for formal lending institutions, in particular commercial banks, because of risks attributed to the sector(Augustin, 2012). To some extent, formal sources of credit act as a complement to the informal source because of the supply-demand gap in credit availability from informal sources (Adeagbo & Awoyinka, 2006). The informal sources take control of credit supply to smallholder farmers by reducing lending conditions because of access to keen information of business capacity and attitudes about borrowers that may increase trust for repayment (Diagne & Zeller, 2001).

In the time that demand for credit by tea farmers is crucial to respond to the need for investment at the desired level, low ratio reported on credit disbursed for smallholder farmers could discourage investment in the tea value chain especially private tea factories that depend on a daily supply of green tea leaves. Therefore, borrowing arrangements necessitate the analysis by inspecting the role of borrowers in choosing credit source and influencing factors to inform policy makers on needed lending system adjustment in the sector to increase tea production. Therefore, the first specific objective of this study aims to explore the factors influencing the choice of credit source among tea household farmers in the Nyaruguru district in the Southern province, Rwanda.

3.2.Materials and methods

3.2.1. *Data*

The purpose of the study is to understand why tea farmers choose to utilise different sources of credit to meet tea production cost. Tea farmers from two cooperatives operating in the Nyaruguru District, Southern Province of Rwanda, who received credit at least during the last three years from 2016 up to 2018 were included in the analysis. In addition, the survey considered tea credits received both in cash and no-cash from available source (s) of credit at farmers' *choices* upon complying with borrowing requirements.

Nyaruguru District was chosen purposively because tea production is one of economic activities, source of employment and income for its people. Tea is leading other crops produced in the District. It is being produced in ten (10) out of fourteen (14) sectors of the district that grow tea. The District is implementing the national tea expansion program since 2012 that aimed at increasing tea production by increasing land size and inputs application to meet the national targets for the sector. Therefore, tea farmers had to access and often use credit either in cash, in-kind or both in the study area. Using the formula of Yamane (1967) for a finite population, of the total 3,445 tea households grouped into two cooperatives, the data were collected by interviewing around 358 tea households selected randomly. Although the sampling was conducted in 2019 (September to November), the information about the credit utilisation pertained to the three years ahead of that date[8].

The study had among assumptions that a tea farmer was not restricted to borrow from a single source for credit. In other words, he or she could utilise more than one source for desired credit. Therefore, all possible sources of credit that were utilised over the period indicated by a tea farmer were asked during a survey. Reliability and validity tests for the questionnaire were also done during the piloting session to minimise unobserved disturbances. Otherwise, they were are expected to be captured in error term during analysis (Cappellari & Jenkins, 2003; Tarekegn *et al.*, 2017). Data collected were analysed using STATA version 16.

3.2.2. *The empirical model*

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[8] Fiscal year starts July 1st to June 30th of the following year, collected information pertained the period from July 2016 to June 2019.

The freedom of choosing among available credit sources in the area is behind the selection of the appropriate econometric model for the analysis. The multivariate model was used to account for non-exclusive and more than two categories for the dependent variable(W. H. Greene, 2002). The multivariate model has been developed for econometric analyses to regress simultaneously multiple binary outcome equations(Cappellari & Jenkins, 2003). The model has the analytical capacity to handle the limitations claimed for a multinomial model that fails to account for a non-exclusivity among alternative and multiple binary outcome categories in the dependent variable(Greene, 2002). However, both multivariate and multinomial models have the advantage of logistic regressions built-in that gives them a capacity of regressing multiple binary outcome equations where each category is compared to a reference category. e.g., tea household farmers not borrowing are compared with those borrowing from a specific credit source.

The choice of credit sources by farmers in the constructed model has three binary outcomes in the dependent variable. The first category (Y_1) given that a tea household had borrowed from a formal source, the second category Y_2) given that a tea household had borrowed from informal source and the third category (Y_3) given that that a tea household had borrowed from both combined sources (formal and informal sources). These three categories are dichotomous with 1 if the answer was yes and 0 otherwise. Following standard treatment of dichotomous outcomes, the study approach assumes the existence of latent variables for the three corresponding dependent variables.

$$\begin{cases} Y_{1i}^* = x_{1i}\beta_1 + \varepsilon_{1i} \\ Y_{2i}^* = x_{2i}\beta_2 + \varepsilon_{2i} \\ Y_{3i}^* = x_{3i}\beta_3 + \varepsilon_{3i} \end{cases} \text{...……………………..…………….... (4)}$$

For each dependent variable, the farmer's decision to utilise formal, informal or combined sources respectively is further expressed as follows;

$$Y_{1i} = \begin{cases} 1 \; if \; Y_{1s}^* > 0 \\ 0 \; Otherwise \end{cases} \text{……………………….…….…….………………………..…….(6)}$$

$$Y_{2i} = \begin{cases} 1 \; if \; Y_{2s}^* > 0 \\ 0 \; Otherwise \end{cases} \text{……………………………………………….……...(7)}$$

$$Y_{3i} = \begin{cases} 1 \; if \; Y_{3s}^* > 0 \\ 0 \; Otherwise \end{cases} \text{………………………………………………… (8)}$$

The model can estimate β_1, β_2 and β_3 and the error terms jointly on conditional of following a multivariate normal distribution, with zero mean and normal variance of one unit. Therefore, a matrix for symmetric covariance Ω (μ_1, μ_2, μ_3) MVN $\sim$ (0, Ω) is given by:

$$\Omega_= \begin{vmatrix} 1 & \rho x_1 x_2 & \rho x_1 x_3 \\ \rho x_2 x_1 & 1 & \rho x_2 x_3 \\ \rho x_3 x_1 & \rho x_3 x_2 & 1 \end{vmatrix} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(9)}$$

The matrix of covariance ρ_{is} is the pairwise of correlated coefficients of the error terms corresponding to choices and they have to be estimated. The non-negative diagonal elements represent an unobserved correlation in errors between multiple latent equations. In this way, the sign of ρ has information. A positive sign shows a complementary relationship of sources of credit while a negative correlation means a substitution of sources of credits.

By following the formula of Cappellari and Jenkins (2003), the function of log-likelihood is specified as follows:

$$lnCs = \sum_{i=1}^{n} \omega_i ln\delta(\theta_i, \vartheta) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(10)}$$

Where Cs represents type credit source, ω_i denotes optional weight for observation i. while δ_i is the standard normal distribution with θ_i and ϑ arguments. These last can be expressed follow:

$$\theta_i = (S_{1i}\beta_1 x_{1i}, S_{2i}\beta_2 x_{3i}, S_{3i}\beta_3 S_{3i} x_{3i}), \text{ while } \vartheta_{is} = 1 \ for \ j = S \ and \dots\dots\dots\dots\dots\dots \text{(11)}$$

$$\vartheta_{js} = \Omega_{sj=}S_{ij}S_{is}\rho_{jk} \quad for \ j \neq S, \ S = 1,2,3 \quad with \ S_{is} = \ 2y_{is} - 1\dots\dots\dots\dots\dots\dots \text{(12)}$$

with S represents a source of credit.

More specifically, the multivariate probit model is further expressed as

$$Cs_{F1} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \cdots \dots\dots\dots\dots \dots\dots\dots\dots +\beta_n x_n + \mu \dots\dots\dots\dots \text{(13)}$$

With Cs as the type of source of credit utilised, $x_i \longrightarrow x_n$ is representing the factors influencing the farmers' decision to utilise credit source (s) and μ as the error term. According to Green (2002) and Wooldridge (2002), the regression coefficients of the multivariate probit are interpreted using marginal effects of change in the explanatory variable on the expected value of the dependent variable.

3.3.Results and discussion

This section presents the results into two categories. The first category concerns statistical descriptive analysis of the household characteristics of tea farmers as well as farm characteristics. Specifically, this section presents details of these characteristics, types and sources of credit utilised by farmers. The second category presents the estimates from multivariate probit with respect to the marginal effects of selected factors that are key results under this chapter.

3.3.1. Descriptive analysis: types of credits sources

The study has a prior assumption that tea household farmers could use different sources of credit by borrowing either from a single source or more than one and the choice might vary from one year to another. During the period considered for this study (2016-2018), tea farmers had obtained credit from different lending sources. It was dedicated to tea production only. Therefore, the following analysis considered all the available sources in which farmers had approached for credit both formal and informal sources during the aforementioned period.

Results in Table 3.1 showed that tea farmers in the study area had utilised either one of the two categories of credit sources: formal and informal and some others preferred to combined these sources. From the findings, a maximum of tea household farmers had utilised informal sources. Around 31.3% had borrowed from formal sources, 81.0% had utilised informal sources while around 65.8 % of them had utilised both formal and informal sources to meet their needs. From the formal sector, tea farmers utilised SACCOs (18.4%) and very few borrowed from commercial banks (7.3%) and Microfinance (5.3%). Formal sources include commercial and development banks. The study identified only two banks i.e. People' Bank of Rwanda (BPR) and Development Bank of Rwanda (BRD) that supplied credit to a few tea farmers. During the survey, respondents highlighted that DBR was the only one that provided aggregated tea credits through the respective tea cooperatives of farmers.

On other hand, tea cooperatives are predominantly informal sources that provided credits for the majority of farmers (64.5%) while some others indicated also friends and relatives (13.1%). However, tontines represent a small percentage in serving credits for tea farmers (3.4%) in the area. The results agree with the findings that informal sources serve many farmers in the area which fall in our expectation(Papias & Ganesan, 2010). At the national level, the National Institute of Statistics of Rwanda (NISR) reported that 39.6% of the population had used formal mechanisms, 40.2% informal while 32.6% used their owned mechanisms to meet the needs(NISR, 2012).

Table 3.1 Distribution of tea household farmers according to the utilised credit sources

	Sources of credits	Frequency	Percentage (%)	
Formal	SACCO	66	18.4	
	Commercial Banks	26	7.3	31.3
	Microfinances	19	5.3	
Informal	Tea cooperatives	231	64.5	
	Tontines	12	3.4	81.0
	Friends and Relatives	47	13.1	

3.3.2. Socio-economic of household tea farmers and institutions in Nyaruguru District

As aforementioned, the results in the Table 3.2, show that tea household farmers have utilised fewer formal sources than informal sources with 31.5% and 81.0% respectively. Table 3 shows descriptive statistics of selected variables. Out of 358 household tea farmers interviewed, about 83% of households were headed by males while 17% were headed by females. The average age of household-head was 52 years. The results are in range with national information about the district (GOR, 2018) where male-headed households represented 73.2% with an average age of 51 years. The household heads have had approximately 6 years of formal education that is at least the primary school level in Rwanda with average family members of 6 persons per family. It was also found that a household tea farmer averagely owns 0.56 hectares of tea plantation. The results showed that tea households averagely earned more income (590,512 Frw) compared to the overall households' income in the district (488,988 FRW) for the last three years.

The findings showed that around 71% of interviewed farmers had accessed information about credit services from lending institutions before borrowing and 61% of them possessed required collateral. In most cases, tea plantation was the type of collateral that most creditors preferred. The majority of tea farmers (88%) participated in training to increase their knowledge on good agricultural practices (GAP) of tea production provided by the tea division, a department of the National Agricultural Export Development Board (NAEB) through their respective cooperatives.

Table 3.2 Type of sources of credit and explanatory variables (n=358)

Variables	Description	Mean	Std. dev.
Dependent variables (type of source of credit)			
Formal source (FS)	Use of the formal source, 1=yes and 0= 0therwise	0.31	0.46
Informal source (IS)	Use of the informal source, 1=yes and 0= 0therwise	0.81	0.39
Combination (CN)	Combined sources, 1=yes and 0= 0therwise	0.86	0.35
Independent variables			
Age	Age of household head in years	52.1	11.83
Gender	1 if the head is male	0.83	0.38
Education	Years of schooling of the household head	5.72	4.27
Household size	Number of family members	6.10	1.91
Tea farm area	Size of owned tea plantation in hectares	0.56	0.83
Household tea income	Rwandan francs	590,512	977,886
Credit information	1 if the farmer had information about credit before borrowing	0.71	0.45
Collateral	1 if the farmer had a required collateral	0.61	0.49
Training on Credit management	1 if the farmer participated in training on credit management	0.24	0.43
Training on GAP	1 if the farmer participated in training on GAP	0.88	0.34
Group credit	1 if the farmer received joint/group credit	0.54	0.50
Credit Size	Amount of received credit in Rwandan francs	474,073	687,375
Distance	Distance to nearest formal lender institution	6.04	5.20
Interest rate	Nominal interest rate	0.04	0.03

It was found also that average of farmers who received joint credit accounted for 54% against 46% who received individual credit. Findings showed that they received 474,073 francs as the average credit size in the last three years. The interest rate was found to be low (average of 4%) as the majority of tea farmers borrowed from informal sources where the charged interest rate is almost zero compared to the commercial banks.

Table 3.3 and 3.4 below show the test of mean differences for selected socio-economic and institutional characteristics across sources of credit used. The results show that factors influencing farmers' decisions vary and some were significant depending on the utilized source of credit. Factors such as tea plantation size, desired credit amount, interest rate and possession of required collateral value were significant across all sources of credit used. The size of tea plantation usually plays an important role in making borrowing decisions in the area as they provide a guarantee to both formal and informal lending institutions.

The credit size was significant at 5% and negative for formal sources, while it was found to be significant at 1% and positive for informal sources and combination. This is because when farmers desire short term and a small amount of credit they prefer where the interest rate is low with a flexible payback period (significant at 1%), and these are informal sources. For the same reason, around 81% of farmers preferred informal sources against 47% borrowed from formal sources. Two variables i.e., age and education were not found significant to influence farmers' decisions to borrow from any source of credit.

Table 3.3Association of socio-economic factors determining the choice of credit source

Variables	*Formal source users*		*Informal source users*		*Combined sources*	
	Mean and Std. dev.	*t*-test	Mean and Std. dev.	*t*-test	Mean and Std. dev.	*t*-test
Age	52.0 (10.9)	0.11	52.2 (12.3)	-0.19	52.2 (12.3)	-0.19
Education	5.3 (4.1)	-0.17	5.2 (4.3)	0.79	5.3 (4.3)	-0.69
Household size	6.5 (1.8)	2.39**	6.0 (2.0)	1.36	6.0 (1.9)	1.42
Tea Plantation area (ha)	0.78 (0.94)	- 3.45***	0.41 (0.7)	7.33***	0.50 (0.80)	3.45***
Distance[9] (km)	6.43 (5.81)	-0.95	6.0 (5.03)	0.60	6.03 (5.08)	0.08

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[9] Distance to nearest lending institution

Variables	Formal source		Informal source		Combined sources	
Interest rate (monthly)	0.06 (0.04)	-9.21***	0.04 (0.02)	6.16***	0.04 (0.03)	2.29**
Payback period[10]	12.79 (11.72)	0.51	12.3 (17.72)	2.78***	12.94 (17.91)	1.47
Credit size	589,556 (843,718)	-2.16**	259,544.6 (246,830)	15.94***	334,559 (43,5254)	10.85***
Household income	1,386,716 (1,209,838)	-0.23	1,229,999 (977,931)	4.89***	1,277,209 (1053412)	3.75***

*, ** and *** indicate statistical significance of mean difference at 10, 5 and 1 % level of significance

The level of household income, though less, was found more significant at 1% when borrowing from informal sources. This is due to the fact that informal lenders have access to keen information of business capacity, socio-economic status and attitudes about borrowers which may increase trust for repayment and the similar reason was motivated by other related findings(Kofarmata *et al.*, 2016). However, the need for money to cover other household expenses mainly schooling children influences much to borrow from formal sources for large and long-term credit than borrowing from informal sources. The fact is that the loan to meet university fee for eligible students is only offered by the development bank of Rwanda (DBR). In such a situation, a household size with at least one person admitted to a university for studies is likely to borrow money to finance his or her studies. Similarly, with other related studies, some factors included in the current analysis such as age, education level of the household head and distance to the nearest lending institutions were not significant to influence farmers' decisions across all types of sources of credit(Mpuga, 2010; Nwaru *et al.*, 2011).

Table 3.4 Association of institutional factors across the type of sources of credit utilised

Variables	Formal source users		Informal source users		Combined sources	
	(%)	χ^2	(%)	χ^2	(%)	χ^2
Information on credit	34.51	4.2877**	78.82	2.7427*	83.92	2.4366
Group credit	29.17	0.8643	86.46	8.0014***	90.63	8.0415***
Collateral	47.03	65.0614***	81.01	9.9372***	85.75	5.8595**

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[10] The time between the first payment on a credit and its maturity, it was measured in number of months

Training on credit mgt	31.28	0.3756	81.01	1.1759	85.75	2.9540*
Training on GAP	31.28	0.0854	81.01	15.9541***	85.75	11.9075***

*, ** and *** indicate statistical significance at 10, 5 and 1 % level of significance

The results in Table 3.5 also show that only 34.5% of farmers who had information about credit services, borrowed from a formal source more significantly than those who borrowed from informal or choosing to combine sources. This is because to get credit from a formal source, the applicant must comply with a set of requirements established by the lending institutions. For this reason, credit seekers have to know about those requirements before proceeding to the application. This is different from the informal source, where a large number of farmers received credit in kind as fertilisers without even knowing details in the signed agreement between cooperative leaders and lending institutions on behalf of members. In this situation, farmers could combine sources of credit by borrowing from formal lending institutions (86.46%) while receiving a joint credit as fertilisers from either cooperative or input sellers (90.63%). It was found that borrowing from informal source increased if a farmer participated in training on Good Agricultural Practices (GAP) such as maintenance of tea plantations and combining sources as well 81.0% and 85.8% respectively. However, participating in training on credit management did not affect farmers' borrowing decisions. With similar reason found, the borrowing decision depends more on the applicant's needs and his repayment capacity than the financial marketing approach used by lending institutions(Pishbahar et al., 2015).

Type of credits sources utilised by tea household farmers in Nyaruguru district

Results in Table 3.5 shows the Wald test and the maximum likelihood of multivariate estimations on the factors influencing farmers' decisions to utilise different sources of credit. The sources are categorised as formal, informal and combined sources of credit. the Wald test ((χ^2 (42) = 192.38, $p>$ chi2 = 0.0000)) is significant at 1% to mean that the subset of coefficients is jointly significant in the model and the power of selected factors for the model is satisfactory. Likewise, the likelihood ratio test (LR (χ^2 (3) = 97.3888, $p>$ chi2 = 0.0000) for the independence of the terms of the residuals is strongly significant at 1% thus implying that different sources in their defined categories are not mutually independent. Therefore, if decisions to choose the three sources of credit are interdependent of tea household decisions, the multivariate model is supported to be used for modelling.

Table 3.5Estimated correlation matrix of sources of credit from Multivariate Probit model

	Formal source	Informal source	Combination
Formal source	1.0000		
Informal source	-0.2896***	1.0000	
Combination	-0.1024	0.9149***	1.0000

Likelihood ratio test of rho21 = rho31 = rho32 = 0: Chi2(3) = 97.3888 Prob > chi2 = 0.0000

Number of observations =358

Log-likelihood ratio test =-302.81059

Wald (χ^2 (42)) = 192.38, Prob> chi2 = 0.0000***

*, ** and *** indicate statistical significance at 10, 5 and 1 % level of significance

In the same Table (3.5), correlation coefficients matrix between error terms of the sources of credit are presented which reflected in likelihood ratio statistics. The formal and informal sources are negatively interdependent while informal and the combination of both sources (formal and informal) are positively interdependent and significant at 1%. This can mean that a tea farmer who is using formal sources is less likely to utilise informal sources or combining sources. Similarly, a tea farmer who used informal sources was more likely to combine sources of credit. This indicates that farmers are more secured for credit from formal sources when they can also obtain credit from informal sources. However, when a farmer is unable to obtain credit from both sources, there is a competitive relationship of formal source with informal source among tea farmers.

The multivariate estimations in Table 3.6 show that some of the selected variables were differently significant at more than one source of credit, two were significant only for formal source while three were significant for both informal and combined sources of credit. Household size has a positive relationship with the likelihood of choosing a formal source for desired credit at 5% levels of significance. Like in a different study (Bendig *et al.*, 2009), an increase in household size increased the probability of utilising formal sources to get credit by 10.5% when other factors are held constant. This implies that tea farmers with a large number of dependent members were more likely to borrow from formal sources such as commercial banks and microfinance institutions. The possible reason for this situation is the need for school fees for children in high schools and universities which is ranked as the second after agriculture

and livestock to allocate received loan and health insurance that are important expenses for households in Rwanda(GOR, 2018).

Table 3.6 Multivariate Probit estimates of factors influencing utilisation of sources of credit

Variables	Formal source		Informal source		Combined sources	
	Coefficients	SE	Coefficients	SE	Coefficients	SE
Age	-0.003	0.008	-0.001	0.009	0.008	0.009
Education	-0.008	0.022	-0.002	0.025	0.031	0.025
Household size	0.105**	0.047	-0.544	0.055	-0.020	0.052
Distance	-0.015	0.016	0.005	0.020	0.019	0.020
Payback period	-0.010	0.008	0.010	0.009	0.011	0.010
Info. about credit	-0.164	0.204	0.257	0.249	-0.056	0.229
Joint credit	-0.078	0.173	0.469**	0.206	0.504**	0.201
Collateral	0.855***	0.133	-0.098	0.141	0.249*	0.142
Training on credit mgt	-0.221	0.218	-0.027	0.229	0.014	0.224
Training on GAP	0.492*	0.297	0.769**	0.305	0.689**	0.276
Interest rate	0.850***	0.156	-0.127	0.097	0.116	0.099
Size of credit	-0.131	0.088	-0.832***	0.120	-0.663***	0.115
Household income	-0.115	0.082	-0.292***	0.113	-0.214**	0.107
Tea plantation area	0.248**	0.100	-0.399***	0.112	-0.117	0.093
constant	1.087	1.528	15.218***	2.321	11.389***	2.171

 *, ** and *** indicate statistical significance at 10, 5 and 1 % level of significance

Receiving credit in groups was positively significant at 5% and influencing farmers to get credit from informal source and combination of sources by 46.9% and 50.4% respectively when other factors are held constant. This implies that the collective responsibilities of cooperative members is likely and positively influencing the use of informal and combination sources. This is because group membership can be used as a guarantee to informal lenders and cooperatives can use this approach to get credit from even formal sources on behalf of members when approved by the general assembly.

Having collateral asset was positively significant at 5% for formal source and 10% for combined sources. It means that borrowing from formal was likely increased by 85.5% and

combined sources by 24.9% when other factors are held constant. The result agrees with the findings of the study of Mwendwa (2013). He showed that collate-able asset is mandatory for formal lending institutions mainly commercial banks and microfinance institutions whereas, for other sources, it could require only to be a tea farmer and recognised by cooperative as a guarantee(Mwendwa, 2013).

The results revealed also that participating in training on good agricultural practices and maintenance of tea plantations was positively significant at 10% for formal sources and 5% for both informal and combination of sources. That is increased participation in one more training would lead to 49.2%, 74.5% and 53.4% increase in using formal, informal and combined sources respectively. Technical training on good practices to maintain tea plantations were very important for farmers and the level of tea production as it has increased the farmers' knowledge and skills and they raised the need for credit to meet input costs for tea production(George & Shem, 2012). In this way, inputs sellers, supplying fertilisers in bulk through cooperatives becomes a priority to the choices of farmers to acquire inputs as credit that they usually pay back upon supplying produce to the factories. This implies that farmers prefer informal over formal sources as they could save credit-related costs, i.e., interest rate and disbursement time that would take to borrow from formal sources.

The coefficient for interest rate was positive and significant at a 1% level for only the formal source. The results showed that the interest rate charged was higher to borrow from formal sources than to borrow from informal sources. However, the conclusion could not be generalised because the received credit from informal sources like cooperatives and input sellers was mostly in-kind such as input fertilisers. Therefore, farmers could not value imputed interest rate during borrowing time. The results also showed that the amount of received credit influenced negatively and significant by 1% of the borrowers' decisions to seek credit from informal sources or to combine both informal or formal sources. That is when 1% decreased in size of desired credit, farmers' decisions to borrow from informal and combining both sources were affected by 83.2% and 66.3% respectively. The findings lead to a conclusion that lower-income households' category that determines the size of desired credit to borrow are more likely to borrow from informal sources. The results concur with De Janvry *et al.* (2005) that an increase in household income from non-farm business activities can help to meet desired investment that results in low dependence on sources of credit.

The results also showed that the coefficient of tea farm size owned by households was at a 1% level of significance for both formal and informal sources but with opposite signs. Positive for formal and negative for informal sources to mean that this factor created a competitive decision to borrow either in formal or informal sources depending on the size of owned tea plantations. Thus, an increased 1 unit of plot size of tea plantation would lead to an increase of 24.8% in using formal sources and decreased by 39.9% to use informal sources. These findings confirm that borrowing from any source of credit increased if a borrower has had a tea plantation. Therefore, the size of a tea plantation is a valuable asset preferred by most lenders as long-term financial security for borrowers to get credit.

3.4. Conclusion and recommendation

This article has analysed factors influencing farmers' decisions to utilise credit sources for desired credit. Generally, it is practical to borrow from formal sources of credit when an applicant is eligible for the evaluation of lending institutions; otherwise, informal sources are preferred. Determinants of access to credit have been reported in various studies in some contexts. However, existing empirical findings have missed information on how farmers choose a potential source of credit to utilise and inducing factors while the decisions made about the source can further influence the utilisation of received credit among competing uses. The current study has tried to make understanding from another side of credit seekers' decisions when choosing a particular source of credit and the determinant factors. A survey was conducted on 358 tea growers selected randomly in two cooperatives that operating in the Nyaruguru district. A multivariate probit model was then used to examine factors influencing tea households' decisions to choose a source of credit.

The results showed that those who borrowed from informal sources are less likely to borrow from formal sources. However, they can choose to combine sources of credit both informal and formal as a safeguard strategy and in particular when desired credit is not obtained from a single source. Lack of training on credit management can justify the difference between utilised sources of credit in the area. If farmers prefer to use mostly informal sources and receive a small amount of credit, then this can affect the level of investment in the tea sector consequently it can affect the desired production of tea and development of the tea sector if the government is targeting production through the intensive system. In addition, results showed that a form of no cash credit such as fertilisers are important for tea farmers and mostly are provided by informal sources. In this context, let lending institutions that targeting small scale farmers

channelise credit via farmers' organisations to meet mutual profit. Again, any intervention for capacitating tea cooperatives is recommended. This can allow tea cooperatives to borrow from any source and an increasing amount of credit on behalf of the members using collective responsibilities as a guarantee. This approach of integrating farmers in financing the tea sector will also be a sustainable solution for cases of credit diversion, mismanagement of credit and bad debts that are known among tea farmers in the area.

CHAPTER FOUR

UTILISATION OF FARM CREDITS: LESSONS FROM TEA FARMERS OF THE NYARUGURU DISTRICT IN SOUTHERN PROVINCE, RWANDA

Abstract

Over the period from 2008, the Government of Rwanda developed policies and made interventions to reduce the financing gap between Agriculture value chains and other economic sectors; services and Industry. The interventions targeted also to reduce the financial services provision gap between urban cities and rural areas, in particular by lowering borrowing constraints by smallholder farmers. Credits utilisation has been reported amongst challenges to affect not only green tea leaves production but also the production capacity of the processing factories in the Nyaruguru district in the Southern Province, Rwanda. This paper examines the factors influencing the utilisation of credit for tea enterprise production and the conditions to inform stakeholders and policymakers in the Rwandan tea sector. Through purposive and random techniques, the study used data collected from 358 tea-farming households. A fractional regression model was utilised in the analysis. Factors like access to credit in the group ($p<0.01$), training on tea agricultural practices and credit management ($p<0.01$), level of production costs ($p<0.01$) and type of lending sources ($p<0.01$) were shown to influence the rate of credit allocated for tea production projects while engagement of tea-farming households in off-farm businesses ($p<0.01$) and larger size of credit($p<0.01$) both increased incidences of credit diversion to other than tea farming uses. Policymakers can intervene for mechanisms that improve management and accountability of tea farmers' organisations as emerging players in the tea sector. Also, public policies should integrate other economic and social attributes that may have real-valued utilities for rural tea-farming households to sustain living needs if they have the right to choose and engage in, a certain range of income activities. Finally, the results showed that providing non-cash credits like input fertilisers could be another strategy for the effective utilisation of credits by household farmers.

Keywords: tea credit, credit diversion, credit utilisation, fractional regression model, tea-farming household interest.

4.1.Introduction

Tea production is a traditional and important cash crop in Rwanda. Since its introduction by missionaries in 1952 years, tea has become an economic activity for purposively export. Tea farming progressed on a small scale and is currently expanding in Northern, Western and

Southern provinces. Rwanda is naturally advantaged for tea growing factors through ideal climate, tropical, volcanic soils and well-distributed rainfall fluctuating between 1,200mm to 1,400mm per annum. Mostly tea is cultivated on hillside areas and drained marshes with altitude that ranges from 1,550 m to 2,500 m (International Fund for Agricultural Development [IFAD] (IFAD, 2005). Currently, the tea subsector is the largest employer in Rwanda of both casual and self-employed people and remains a major source of income for thousands of household tea farmers in rural areas. Today, the Rwandan tea sector consists of 16 operational tea factories that are managed by private companies and 16 collaborative tea cooperatives that groups a larger percentage of smallholder tea farmers who own more than 70% of total tea zones in the country. Made tea represents a significant share in agricultural exports and foreign earnings for the country over many years (Ministry of Agriculture and Animal Resources [MINAGRI], (MINAGRI, 2018b). In particular, tea is leading major economic activities in the Nyaruguru district under consideration for this study (National Agricultural Export Development Board [NAEB],(NAEB, 2016).

The economic role of the tea sector is further considered in the country's long-term targets for agricultural exports and earnings in the 2018-2024 Strategic Plan for Agriculture Transformation (SPAT) and the National Strategy for Transformation (NST1), 2017-2024. The 2018–2024 strategic plan for agriculture transformation targets to increase tea production from 7 MT/ha to 9 MT/ha and exports by 73%(MINAGRI, 2018b). The plan will be achieved through the introduction of high-yielding clones, increased fertiliser application and expanding land area for tea production (MINAGRI, 2018b). Tea farmers are key stakeholders who will contribute to governmental targets realisation. They are required to adopt modern techniques that integrate the intensive use of fertilisers and improved seedlings in tea farming in order to increase the production of green tea leaves. The necessity of accessing and utilising credit to purchase agricultural inputs is crucial for tea farmers to increase green tea leaf production and to meet factories' demand for raw materials(NAEB, 2018).

Tea credits lending sources in Rwanda consist of formal sources that include microfinance, commercial and development banks, and informal credit sources that are comprised of (a) private money lenders, (b) rotating savings and credit associations (ROSCA), (c) tontines and input traders, and (d) friends and relatives. Tea-farming households have the right to borrow from any of these sources for the desired credit amount and or input credits for tea production purpose. However, if incidences of credit diversion to uses other than tea farming increase, it

may affect the level of tea green leaf production which also determines factories' outputs of 'made tea' and the volume of exports for the sector. Available studies were limited in evaluating responsible factors and the conditions that influence access to credit(Augustin, 2012; Ismael, 2013; Muhongayire *et al.*, 2013; Papias & Ganesan, 2010). Furthermore, there is a need to understand the other side of utilisation for the accessed farm credits. The second specific objective of the current study contributes to this by investigating the influencing factors of utilising farm credits for tea production among tea-farming households in the Nyaruguru district in Southern Province, Rwanda.

Literature Review

Despite the challenges in accessing agricultural credits for small-scale farmers in the rural areas (Oboh & Ekpebu, 2011), increased incidences of farm credits diversion remain amongst the challenges to achieving the targeted production in the agriculture sector (Enya & Adinya, 2008; Oboh & Kushwaha, 2009; Riaz *et al.*, 2012). The importance also varies from one context to another, for instance, Khatun (2017) highlighted that agricultural credit diverted was estimated at 44.26% to cover consumption needs in Bangladesh and around 35% was used for consumption as well in Karnataka in India (Devi, 2018). Similarly, 20% was diverted and used for consumption needs in Punjab in Pakistan (Waheed, 2009). In Ghana, 27.57% of credit diverted to a non-farm sector(Kuwornu *et al.*, 2012) and 43.9% was used for other purposes in Nigeria (Oboh & Ekpebu, 2011). In Kenya, around 38% was diverted from coffee to other uses including schooling fees (Kamakia, 2016). In Rwanda, out of 465 million Rwandan francs dedicated to tea production uses through farmers cooperatives from the Development Bank of Rwanda, only around 64 million—representing 13.6 %—was used for intended projects of purchasing fertiliser inputs and land preparation(NAEB, 2013), the remaining was used for off-farm tea uses.

Despite engaging in the juggling of credits, a number of studies supported that agricultural loans have a significant impact on improved agricultural production, farm income, and overall living standards of user participants(Diagne & Zeller, 2001; Khodke *et al.*, 2010; Kuwornu *et al.*, 2012; Muhongayire *et al.*, 2013). Some others revealed determinants associated with credit utilisation for intended projects and the impact of expected outcomes among farming households(Gana *et al.*, 2009; Olofinsao *et al.*, 2018; Wivine, 2012). For instance, factors like timely availability of credit, size of households, diversification of businesses, and poor management and skill of farmers - all of which translated into low yield, affected utilisation

89

and increased incidences of credit diversion (Hamidi, 2016; Nimoh *et al.*, 2011; Oboh & Ekpebu, 2011). Whereas (a) age, (b) level of education and income of household head, (c) time of receiving credit, (d) loan size, (e) farm size, (f) type of lending source utilised, and (g) benefiting extension services are likely to increase the rate of credit utilised to planned uses(Gana *et al.*, 2009; Olofinsao *et al.*, 2018; Wivine, 2012). The choice of participants for the end credit uses would be explained by the natural and social attributes that determine the households' satisfaction and level of sustaining life needs within the agricultural household model(De Janvry *et al.*, 2005).

Theoretical framework

The study background takes into consideration *'sustainable rural livelihoods'* within agricultural households and *'utility theory'*. Credits utilisation by tea-farming households could be explained within the framework of sustainable rural livelihoods that illustrates their ability to achieve different livelihood outcomes by combining livelihood resources—tangible and intangible capital—that individuals possess and by using different strategies. Household livelihoods and the strategies that people use to create them are the core of the development. The livelihoods concept has richer connotations and a broader scope to stipulate the means that a household uses to achieve and sustain a certain well-being level. It has been debated as the fundamental intervention approach for poverty eradication and rural development by broadly defining livelihoods as the means and way of sustaining life. It agreed with the classic definitions as the (a) capabilities, (b) assets—both material and social resources, (c) access to these mediated by institutions, and (d) social relations and activities that together determine the living gained by the individual or household (Ellis, 2000; Li *et al.*, 2021; Scoones, 1998). Besides the need of increasing financial capacity for small holder farmers to meet the capital stress and chocks for engaged in production activities like purchasing the farm inputs, they also have natural and social attributes that determine the drive utilisation of available resources for the household living needs like food and enjoy good health. Therefore, in utilising accessed resources they have the right to choose and engage in a certain range of activities.

The current study also refers to the household decision theory and utility function within a 'household' and 'agricultural household' or 'farm household' theories to distinguish an agricultural household from any other by classifying household both in its dual role as consumer and producer which is very important to a range of public policies (De Janvry *et al.*, 2005). In contrast to an outsider's view, many of the people who live on farms may not regard

the farm as their main activity in the wide view of the United Nations Economic Commission for Europe report of 2017 which proves the existence of a real-valued utility function the so-called expected overall utility to be maximised by a rural household from adopted principles of rational choice from alternatives under constrained resources (Li *et al.*, 2021; Mazziotta & Pareto, 2014). In this way, the utilisation decision of the accessed credit for tea production or diverting to off-farm uses is driven by the latent expected utility as a proxy of the degree of household's satisfaction. Therefore, a maximum or full utilisation of accessed credits for green tea leaf production remains the household's expectation to maximise the utility attributed to farm income rather than any other factor.

4.2. Materials and Methods

4.2.1. Data

The study was conducted in the Nyaruguru district in the Southern Province of Rwanda. The district is located between latitude 2° 41' 54" south and longitude 29° 31' 25" east. It is 1,010 square kilometres with an annual average temperature of around 20o C and annual rainfall varies between 1,000 and 1,250 mm depending on the altitude. The soils of the district are generally clay and sandy with a pH that ranges between 5 and 5.5. Such soil is adapted to tea and coffee plants. The choice of the district for the current study is crucial as it represents not only the areas in the country for tea production but also a targeted area for tea expansion programs from 2013. The program engaged intensive use of input fertilisers and adoption of high yielding clones and new construction of tea factories which also increased demand for credits by tea-farming households in the area(NAEB, 2018). in addition, tea is currently produced in 10 out of 14 sectors of the Nyaruguru district. In 2017, the National statistics of Rwanda has ranked tea production as a major economic activity in the district (NISR, 2017).

4.2.2. Sampling Procedure and Sample Size

A multi-stage sampling that involved a purposive and random sampling procedure from the cooperatives of tea farmers that operating in the district. The population is 3,445 as members of these two cooperatives (Cooperative des Théiculteurs Nshili-Kivu [COTHENK] and Cooperative des Theiculteurs de Muganza-Kivu [COTHEMUKI] each has 2,560 and 885 tea-farming households respectively.

Using the Yamane (1967) formula for finite population, the sample was calculated as follows:

$$n = \frac{N}{1+N(e)^2} \quad \text{...} (14)$$

where n is the sample size and N is the population while e represents the level of precision. Therefore, the total sample is calculated as

$$n = \frac{3445}{1+3445(0.05^2)} = 358 \quad \text{...} (16)$$

Thereafter, respondents were proportionally drawn from each cooperative respectively using the proportion formula as follows:

$$n_i = n\frac{N_i}{N} \text{...} (17)$$

where ni is the number of respondents from each cooperative, n represents total respondents in both tea cooperatives, Ni is the relative population in each cooperative and, N stands for the total of the targeted population in tea cooperatives. The sampled tea-farming households are shown in the following Table 4.1.

Table 4.1 Sample Size

Cooperatives	Sub-Population	Sample size
COTHENK	2,560	266
COOTHEMUKI	885	92
Total	**3,445**	**358**

4.2.3. *Analytical method*

The magnitude of responsible factors that influenced credit utilisation on tea production was empirically estimated as the marginal effect on the dependent variable. The dependent variable represents a percentage of the amount of received credit that was used on tea enterprise. For a continuous dependent variable (y) that ranges within one-unit interval as [0,1] or (0,1) such as fractions, proportions, rates and percentages, indices, and probabilities the classical models like linear regression, Tobit and non-linear squares were proved to have some limitations in the analysis of the data. For instance, linear regression failed to capture non-linear relationships especially when the outcome variable is near to zero or one. The predictions could fall outside those intervals. Other models are unlikely to be efficient for natural observations because common distributions of fractional response imply heteroscedasticity distortions which may

cause inconsistency and invalidate usual test statistics(Arabmazar & Schmidt, 1981; Gallani & Krishnan, 2015; Wooldridge, 2002).

The limitations and critics attributed to the existing classic models for continuous dependent variables were considered for the current analysis and opted a fractional regression model that was proposed by Pepke and Wooldridge is selected to analyse the credit utilisation among competing uses by tea household farmers (Papke & Wooldridge, 1996, 2008). The fractional regression has the advantage of integrating non-linear models like probit, and logit models while restricting the mean of the dependent variable (y) conditional on explanatory variables (x). Parameters of the model are estimated using the quasi-maximum likelihood method (QML) estimator under general linear model conditions (Gallani & Krishnan, 2015). The fractional regression model has the advantage of computing robust standard errors by default, therefore; there is no need to know the true distribution to obtain consistent parameter estimates.

4.2.4. *Specification of the fractional regression model*

Since dependent variable y outcomes fall within [0,1], the regression of its mean $E(y|x)$ conditional on x is also expected to fall in the same unit interval [0,1] and mathematically it can be expressed as follows;

$$E(Y|X) = G(X\beta) = \frac{exp\,(x\beta)}{1+exp(X\beta)} = \frac{1}{[1+exp(-X\beta)]} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(18)$$

where $G(.)$ is a known function satisfying $0 < G(z) < 1 \quad \forall z \in \mathbb{R}$, with conditions that y is continuous within a unit interval and $f(y|x)$ is the conditional distribution of y and x is a vector of observed variables whereas β is a vector of parameters to be estimated.

The fractional regression model has the following identical likelihood function to have distributions restricted within one-unit interval.

$$F(Y) = G(X\beta)^Y \times (1 - G(X\beta))^{1-Y} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(19)$$

$for\; 0 \leq Y \leq 1,$

According to (Papke & Wooldridge, 1996), parameters can be estimated in the same manner as in the binary logistic regressions with Quasi-Maximum likelihood (QML) estimator based on the Bernoulli log-likelihood function, therefore the function is re-written as follows:

$$LL_i\,(\beta) = y_i * \log\big(G(x_i\beta)\big) + (1 - y_i) * \log\,(1 - G(x_i\beta))$$

Given that, the Bernoulli distribution is a part of linear exponential families, the Quasi-Maximum likelihood (QML) estimator of β is defined by;

$$\beta \equiv$$
$$arg \max_{\beta} \sum_{i=1}^{N} LL_i(\beta)\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots..(20)$$

Interpretations of average estimated marginal effects from the fractional regression model portray a consistent story as for linear regression coefficients. The empirical model used to estimate the marginal effect of factors influencing credit utilisation on tea production using fractional regression model is presented as follows;

$$Y_{iCUI} = \beta_0 + x_1\beta_1 + x_2\beta_2 + \dots\dots\dots\dots\dots. + x_n\beta_n + \varepsilon_i\dots\dots\dots\dots\dots\dots\dots\dots\dots..\dots\dots..(21)$$

where, Y_{iCUI}= is the amount of received credit utilised for tea production projects (indexed in one unit). x_1 to x_n represents explanatory variables in the respective order.

The credit utilisation index (CUI) was calculated using the following formula to have figures on credit allocation for each individual farmer:

$$Credit\ Utilization\ Index\ on\ tea\ (CUI) = 1 - \frac{Amount\ of\ credit\ used\ to\ off-tea\ uses}{Total\ amount\ of\ credit\ received}\dots\dots\ (22)$$

The index was calculated based on observations on credit utilisation. A positive coefficient indicates the marginal effect of one independent variable due to one unit increases in the dependent variable other factors held constant. For instance, a one-unit increased in the independent variable (x) would lead to a $\beta * 100\%$ increase or decrease in the dependent variable (y). The independent variables included in the model include the age of household head, education level of the household head, household size, type of credit received, experience in tea farming, credit constraint, payback period, Participation in credit management, whether a farmer had received training on good agricultural practices (GAP), timely availability of credit, size of owned tea plantation(s), tea production costs, level of the household income, possession of other off-farm businesses, size of the received credit, and type of credits sources. Details on independent variables used in the model along with expected signs are below presented in the Table 4.2 below.

Table 4.2Description and definitions of variables used in the fractional logit model

Description of variables	Definitions	Expected sign
Dependent Variables		
CUI Credit Utilisation index (CUI)	0≤CUI≤1	
Independent variables		
X_1 Age	Years of household head	+/-
X_2 Sex	Sex of the household head, 1= Male, 0=Female	+

X_3	Education	Years of schooling of the household head	+
X_4	Household size	Number of people in households	+
X_5	Experience in tea farming	Years in tea farming by a household head	+
X_6	Participation in training on GAP	Whether a household head received such training, 1=Yes, 0=No	+
X_7	Training on credit Management	Whether a household head received such training, 1=Yes, 0=No	+
X_8	Tea plantation size	Owned tea plantations by a household in hectares	+
X_9	Total production cost	Total costs of tea production include labour and input fertilisers in Rwandan francs	+
X_{10}	Total household income	Total household income in Rwandan francs,	+
X_{11}	Borrowing from formal sector	1=Yes, 0=No	+/-
X_{12}	Borrowing from informal sector	1=Yes, 0=No	+/-
X_{13}	Type of received credit	Whether a household head has received credit via farmers' group, 1=Yes, 0=No	+
X_{14}	Credit constraint	Whether a household head has received a desired amount, 1=Yes, 0=No	-
X_{15}	Credit disbursement	The period from borrowing time to approval time in days	+/-
X_{16}	Payback period	The period between approval and last instalment date in months	+/-
X_{17}	Having off-tea farm business(es)	Whether a household head has off-tea farm businesses, 1=Yes, 0=No	+/-
X_{18}	Size of credit	The total value in Rwandan francs of approved and received credit per household	+/-

4.3. Results and Discussion

4.3.1. *Tea household characteristics*

Table 4.3 presents descriptive statistics of the variables used in the fractional regression model for the analysis. The results show that there is a significant difference between the two groups of tea-farming households— non-diverted credit and diverted credit farmers —towards credit

utilisation. On average, 69% of the received amount was utilised for tea production projects. Out of 58.4% utilised accessed credit for intended tea production projects (Table 4.3), they have allocated the maximum of the credit accessed (92%) while their counterparts have utilised only 38% of the total credit and the balance was used to other than tea farming.

The results show that there is a statistically significant difference in the age between those who utilised credit for tea production—on average 53 years old—and those who diverted tea credits—on average 51years old. The implication of this result is that probably aged people have fewer ambitions in conducting off-farm rural businesses in the study area. It corresponded very much with the work of Oboh and Ekpebu (2011)that aged people may show uprightness in using received credit for intended projects.

Table 4.3Relationship between characteristics of the tea credit user farmers and credit utilisation

Variables	Overall Mean or % (n=358)	Credit utilisation for tea production (n=209)	Credit diversion to off-tea farm uses (n=149	t-test
Credit utilisation index (CUI); 0≤CUI≤1	0.69	0.92	0.38	-
	(0.32)	(0.11)	(0.23)	29.67***
Age of household head (years)	52	53	51	-2.14**
	(12)	(12)	(11)	
Education level of the household head	5	5	5	0.18
	(4)	(4)	(4)	
Household size	6	6	6	0.96
	(1)	(2)	(2)	
Number of years in tea farming	7.3	7.3	7.4	0.36
	(2.2)	(2.1)	(2.3)	
Credit disbursement (days)	12.1	10.8	13.9	2.31**
	(13.0)	(12.2)	(13.9)	
Payback period (in months)	11.9	10.8	13.5	2.42**
	(10.5)	(10.5)	(10.3)	
Tea plantation size (hectares)	0.94	1.00	0.86	-1.67*

	(0.82)	(0.90)	(0.67)	
Total production cost (Rwandan currency)	262,998	307,940	199,960	-2.84***
	(357,934)	(398,776)	(280,525)	
Total household earnings in Rwandan currency	1,223,848	1,221,402	1,227,279	0.06
	(944,310)	(980,414)	(894,463)	
Size of credit (Rwandan currency)	474,074	370,411	619,478	3.43***
	(687,375)	(542,808)	(830,156)	

Standard deviations in parentheses; *Significant level: *=10%; **=5%; ***=1%. Source: Authors' calculations*

The credit disbursement period was captured during survey interviews as the number of days to mean the timely availability of credit for a borrower to receive the approved amount. This period is very important for utilisation and for what accessed credit is supposed to be utilised by household tea farmers in the study area. For this variable, there was a significant difference between household tea farmers who utilised credit for tea production and those who diverted credits. The assumption was that the shorter the period for approving credit, the better for farmers as they can procure inputs on time. In other words, there is a risk of diverting credit from planned projects to other uses when credit is delayed. The same finding by Sogo-Temi and Olubiyo (2004) found that credit made in a timely manner to agricultural farmers significantly enhances crop production activities because they can acquire inputs on time to meet the crop seasons. Similarly, a payback period defined as a period between the time the credit is approved and the time it has to be fully repaid affects the amount invested in tea projects among farmers as it is significant at a 5% level. The shorter the repayment period, the better for farmers particularly when the credit has to be paid upon supplying green tea leaf to the factories. The study found that there is a significant difference for this range of period captured in months between household tea farmers who utilised credit for tea production and those who diverted credits.

The average owned land under tea production was captured as the size of owned tea plantations in hectares. The average size of owned tea plantations was 0.94 hectares in the study area. For this variable, the results showed a significant difference in the average tea plantations size between farmers who utilised credit for tea production (1ha) and those who diverted credit (0.86ha). There was also a significant difference in the average cost of tea production between the two categorised farmers' groups at a one per cent significance level. Finally, there was also

a significant difference in the size of received credit between the two categories of household farmers at also one per cent significance level.

The results in Table 4.4 below show a statistical significance when a household farmer has accessed credit in the group between farmers who utilised credit for tea production (60.3%) and those who diverted credits (44.4%). This implies that there is a relationship between utilising credit that is accessed in group and its further utilisation for intended tea projects. Furthermore, the average credit received by household tea farmers showed a statistical significance. This is because joint credit is commonly accessed in the form of inputs—mainly fertilisers—through their respective cooperatives where they do procure agricultural inputs in bulk to members. The advantage is that farmers were helped to acquire agricultural inputs on time while being monitored through cooperatives to reduce incidences of credit diversion. This did not necessarily happen to their counterparts who had received individual credit from formal lending sources because the monitoring for disbursed credit is highly limited to the repayment performance in accounts.

Table 4.4Factors Affecting Credit Utilisation for Tea Production

Variables	Overall Mean or % (n=358)	Credit utilisation for tea production (n=209)	Credit diversion to off-tea farm uses (n=149	*Chi-Square (χ2)*
Tea credit allocation (1 if was allocated for tea production)	100	58.4	41.6	-
Age of household head (years)	52 (12)	53 (12)	51 (11)	-2.14**
Household head (male)	82.7	83.7	81.3	0.39
Type of credit (1 if had received a joint credit)	53.6	60.3	44.4	8.95***
Desired credit (1 if a farmer was not constrained)	19.3	24.8	11.1	10.15***
Participation in training on credit Management (1 if had participated in the training)	24.0	26.8	20.8	2.11

Participation in training on GAP (1 if had participated in the training)	87.7	93.3	79.2	14.56***
Having off-tea farm businesses (1 if yes and 0 otherwise)	45.8	28.7	71.5	59.16***
Borrowing from a formal source (1 if yes and 0 otherwise)	31.3	36.8	22.9	7.21***
Borrowing from informal source (1 if yes and 0 otherwise)	81.0	85.6	74.3	7.03***

*Significant level: *=10%; **=5%; ***=1%. Source: Authors' calculations*

The study revealed also that credit constraint plays an important role in utilising credit among household farmers. A farmer is not constrained if he or she has received the desired credit amount. Any approval of a less desired credit amount for a household farmer means that he or she is credit constrained. The results show a significant difference towards credit non-constraint between the two groups of household farmers; those who utilised credit for tea production (24.8%) and those who diverted credits (11.1%). Furthermore, there was a significant difference in participating in the arranged training on good agricultural practices (GAP) between farmers who utilised credit for tea production (93.3%) and those who diverted credits (79.2%). This implies that types of practical training using Farmer Field and Learning Schools' approach (FFLS) are much helpful to improve utilisation of credits and farm inputs among smallholder farmers. Under assumptions, farmers who received on-farm pieces of training likely would improve the credit management and its utilisation for the intended purposes compared to those who did not participate. In another word, fail to attend training on tea production techniques further would affect the way of utilising received inputs on tea farms for some farmers.

This study's findings agree with the previous expectation that tea off-farm businesses are amongst competing uses for the received tea credits in the study area. Statistically, significant variations were observed in the conducting off-tea businesses between household tea farmers who utilised credit for tea production (28.7%) and those who diverted credits (71.5%) at a one per cent significance level.

The type of lending sources also influences the level of utilising the accessed credit on tea projects. Informal sources of credit are significant at the 1% level (P<0.01) and increasing

borrowing from one more informal lender is expected to influence the utilisation of credit for tea production purposes by 76.3 % other factors held constant. Similarly, the regression estimates show that the choice made to borrow from one more formal source of credit would increase the investment in tea production by 30.2 % with other factors held constant. This is because informal sources of credit are more flexible in terms of lending conditions and have closed monitoring systems through farmers' cooperatives than formal sources of credit. In addition, informal lending sources such as input sellers, tea factories, and private lenders could provide desired inputs—chemical fertilisers—in bulk to farmers upon presenting the collective responsibilities of members where one member is collectively cautioned by other members as a guarantee. In the case of credit defaulting, other members have a duty to share his or her part to repay the credit. In contrast, formal lenders could only arrange to follow up visits upon notice of their client's delay in repayment.

In summary, significant variations between the two groups of household tea farmers towards credit utilisation for tea production or otherwise were observed for the variables; amount allocated for tea production, Age of the household head, participation in the training on good agricultural practices (GAP), the size of owned tea plantations, the cost of tea production, credits sources utilised for borrowing, type of accessed credit product (group credit), whether receiving the desired amount, timely available credit, payback period, having off-tea farm businesses and the size of accessed credit. The remained variables used in the model include gender, the sex and education level of the household head, family size, experience in tea farming, participation in the training on credit management and the level of the household income were not significantly distinguishing the farmers towards credit utilisation in the study area.

4.3.2. *Factors for credit utilisation for tea projects*

Results in Table 4.5 are the estimates of the fractional regression model where the credit utilisation index is the dependent variable that varies between zero and one unit. The parameters estimates are obtained by employing *"fracreg logit"* command available in the software of the stata16 version. Preliminary diagnostic tests for the existence of multicollinearity and heteroscedasticity were done using *"vif"* and the White Test respectively using *"hettest"* both *commands* available and run after regression in the same software. The mean Variance Inflation Factor (VIF) value is 1.38 less than 10 and ranges between 1.07 to 2.69 which confirms the absence of multicollinearity. The White test for heteroscedasticity

shows no issue about it as the P-value was not significant (p-value>0.05) to means no issue of independent variable with the residuals.

In the same Table (4.5), the results show that out of eighteen factors used in the model, nine of them are statistically significant and seven of these are significant at a 1% level. Moreover, seven factors: (a) credits in groups, (b) credit non-constraint, (c) training on good agricultural practices (GAP), (d) training on credit management, (e) tea production costs, and types of credit sources—(f)formal and (g) informal—are positively significant in influencing the effective utilisation of accessed credits for tea production among household farmers. Whereas factors like off-tea fam businesses and size of accessed credit are found as the amongst competing uses for tea production projects. Hence, they augment diverting credit from intended projects in the area.

The age of the household head is insignificant in the influencing utilisation of accessed credit for tea production. Education of the household head is also not significant for influencing the farmers on the credit utilisation decision. Generally, the average of household heads' education level in the study area is five years which falls in the primary education level. Therefore, this variable is not statistically significant when other factors are held constant. Similarly, both household size and experience in tea farming variables are found not significant to influence the decision of farmers on utilisation of accessed credit for tea production in the area. The result on the birth rate implies that it is almost the same for the sample while experience in tea production is constantly independent to related tea production investment as tea growers have the closer digits of experience since tea is once planted and remain for long term and continuous production. This means that tea productivity remains dependent on farm inputs application.

The coefficient of accessing credit in the group is positive and significant in influencing credit utilisation for tea production at 1% level (P-value<0.01) other factors held constant. The coefficient of accessing credit in groups of farmers is 0.439 approximately which means that the increase of the amount to be utilised for tea production would increase by 43.9% if a tea farmer receives the credit in the group. The implication of the results is that types of group credits are provided as input fertilisers that are procured in bulk by tea cooperatives and further distributed to members which were found as the most used mechanism and effective to minimise mismanagement of credits in the study area.

Table 4.5 Fractional logit estimates of factors influencing utilisation of credit for tea production

Variables	Coefficient	Std. Err.
Gender of household head (1=Male, 0=Female)	0.208	0.201
Age of household head	0.005*	0.007
Education level of the household head	-0.001	0.016
Household size	-0.002	0.042
Type of received credit (1=if was a group credit, 0=otherwise)	0.439***	0.134
Experience in tea farming	-0.012	0.032
Credit constraint (1=if was not constrained, 0=Otherwise)	0.559**	0.238
Loan payback period (months)	-0.012	0.008
Participation in Training on credit management (1=yes, 0=No)	0.672***	0.178
Participation in training on GAP (1=yes, 0=No)	0.434***	0.091
Credit disbursement (days)	-0.007	0.006
Tea farm size (Ha)	0.105	0.121
Tea production cost (Rwandan currency)	0.972***	0.198
Household income (Rwandan currency)	0.057	0.070
Having off-farm business(es) (1=yes, 0=No)	-0.508***	0.081
Credit Size (Rwandan currency)	-0.613***	0.153
Lending source formal	0.302*	0.162
Lending source informal	0.763***	0.224

Significant level: *=10%; **=5%; ***=1%.

Source: Authors' calculations

A non-constrained farmer was defined as the state in which a household farmer fully received the expected loan amount. Throughout the discussion, it is named credit non-constrained. It was also found to have a positive effect and significance at a 5% level ($P<0.05$) on the amount of credit utilised for tea production. This would increase the utilisation of accessed credit on intended tea production by 55.9% other factors held constant. The assumption is that usually, households have other unrevealed expenses during borrowing which may lead to credit diversions after borrowing such as the need for school fees for educating children, food consumption, health insurance, and so forth. Farmers can also partially divert the amount of received credit to run some rural businesses.

Our findings also show that training on credit management to improve farmers' knowledge about financial services is positively significant at a 1% level (P<0.01). Therefore, training programmes for tea farmers are important to improve the utilisation of accessed farm credits for tea production. One more training session would influence such decisions by 67.2% other factors held constant. Sharing knowledge and techniques about tea production through Farmer Field Schools (FFS) have helped cooperatives to mitigate the number of mismanagement cases among farmers.

The costs for tea production in the study area include (a) capital for mainly chemical fertilisers, (b) paying hired labour for plucking, and (c) rehabilitation of old plantations. The effect of the cost of these inputs was found positive and significant at a 1% level (P<0.01). The results show that a 1 unit increased in tea production input would increase the investment for tea production by 97.2 % when other factors are held constant.

The type of lending source also influences the level of utilising the accessed credit on tea projects. Informal sources of credit are significant at a 1% level (P<0.01) and increasing borrowing from one more informal lender is expected to influence the utilisation of the credit for tea production purpose by 76.3 %, other factors held constant. Similarly, the regression estimates show that the choice made to borrow from one more formal source of credit would increase the investment in tea production by 30.2 % as other factors held constant. This is because informal sources of credit are more flexible in terms of lending conditions and credit repayment conditions than formal sources of credit. Besides, informal lending sources such as input sellers, tea factories, and private lenders could provide desired inputs—chemical fertilisers—in bulk to farmers upon presenting the collective responsibilities of members where one member is collectively cautioned by other members as a guarantee. In the case of credit defaulting, other members have a duty to share his or her part to repay the credit. In contrast, fewer formal lenders could only follow up with the credit users upon notice of their client's delay in repayment.

Results further revealed that the size of credit and conducting off-farm businesses was negative and significant at 1% level (P-value<0.01) to affect the amount of credit allocated for tea production. This would decrease the investment in tea production projects by 50.8% and 61.3% respectively when other factors are held constant. The implication of the results on the credit diversion is probably due to some farmers who may use tea plantations as collateral to engage

in the juggling of credit to other than tea farming uses. Though it is against the contract and it may affect future borrowing, Li *et al.* (2021) argued that credit household users hold an innermost capacity, which is acquired from experience to make rational decisions to maintain certain well-being and to engage in a certain range of economic activities. The remaining factors such as (a) gender and age of the household head, (b) family size, (c) experience, and (d) size of tea plantations owned have logical and explainable coefficient signs, but they are not statistically significant.

4.4.Conclusions and Recommendations

In this chapter, the second objective was to investigate responsible factors that influence the utilisation of credit for tea production in the tea sector in the Nyaraguru district of the southern province of Rwanda. The study used data collected from a sample of 358 tea-farming households and a fractional regression model was used to estimate the marginal effect. The farmers were randomly chosen.

The results show that there is a gap in credit utilisation for planned tea projects in the study area. Around 58.4 % of farmers had utilised accessed credit for intended tea projects against 41.6 % who diverted credits. Factors such as (a) access to credit in groups, (b) receiving the desired credit amount, (c) participating in training on good agricultural practices and credit management, (d) cost of farm inputs, and (d) type of sources of credit were all positive and significantly influenced utilisation of accessed credits for intended tea-farming projects. The results revealed that both off-tea farming businesses and large credits increased incidences of credit diversion among tea-farming households in the study area.

Our study revealed that there is still a long way to go for tea-farming households to fully utilise received credit for primarily tea production. Promoting tea cooperatives and their role in credits distribution and management for effective utilisation is recommended. Much of the work lays on the shoulders of the Government to put in place policy frameworks that can improve management and accountability of tea farmers' organisations as emerging players in the tea sector. Further, tea funding mechanisms should consider the economic and social attributes that may have real-valued utilities for household farmers to reduce incidences of credit diversion from intended projects.

CHAPTER FIVE

EVALUATION OF DETERMINANTS AND EFFECT OF CREDITS ON THE FARM OUTCOME- A Micro-perspective of tea production from Rwanda

Abstract

Credit is a crucial factor for tea growers to pay for physical farm inputs mainly input fertilisers, research and development of high yielding tea clones and labour in order to improve the production of green tea leaf and to meet factories' demand for raw materials. However, mismanagement of accessed credits by farmers has been reported among the snags affecting the sector development. The study analysed the determinants and impact of credit utilisation on farm income among smallholder tea growers in the Nyaruguru Districtin Southern Province, Rwanda. Cross-sectional tea household level data were collected from 358 farmers randomly selected from tea cooperatives. The credit utilisation and causal effect were estimated using the Endogenous Switching Regression model. Results revealed a positive and significant relationship between credit utilisation and tea farm income. Precisely, the causal effect of credit is a 7% increase in tea income for farmers who utilised credit for tea production while its potential effect is up to a 55% decrease in tea income for those who divert credit for out-off tea production uses. Furthermore, training on good agricultural practices and credit management, cost of farm inputs, labour and access to group credit significantly influence utilisation of credit for tea production. However, the size of credit (cash) and off-farm businesses significantly increase the diversion of credit and level of tea farm income. Tea farmers are encouraged to use tea credits for planned projects. Sensitising farmers to procure farm input fertilisers in bulk through cooperatives should be vigorously pursued to discourage credit diversion.

Keywords: Tea credit, Tea farming household, Farm income, Endogenous Switching Regression

5.1.Introduction

Agriculture investment is a national priority for transforming agriculture and greater financial inclusion. The yielded substantial progress in financing agriculture results from government's funding measures for access to financial services for farmers and agribusinesses through the Financial Sector Development Program (2013-2018), The National Financial Inclusion Strategy (NFIS) and the National Agriculture Policy (NAP) (Minagri, 2017). Rwanda additionally so has two key market development entities-the Development Bank of Rwanda

(BRD) and the Business Development Fund (BDF) both are active in the financing agriculture sector. Through the National Bank of Rwanda (NBR) there is a system of monitoring credit disbursed to the agriculture by value chains and value chain stages in all financial institutions-commercial banks, Microfinance (MFIs) and SACCOs. According to the Nair et al .(2018), Agri-finance is a key focus area for Access to Finance, and Rwanda plays a role of a specialised donor-funded initiative and for the World Bank's lending projects. As result, the loans for agriculture increased from 57billion in 2012 to a 90billion in 2016 (Nair *et al.*, 2018) where agri-processing and tea production were leading the investment over this period.

Tea production was among the country priorities for reforms implemented in the agriculture transformation since 2013 because of its economic role for the country(World Bank, 2013). Tea production plays an important role in the establishment of tea factories, job creation for rural communities by increasing farmers' daily income and finally, its exports' share remains significant in the foreign exchange balance for countries like Rwanda (FAO, 2020). Furthermore, the tea sector in Rwanda offers additional advantages. In particular, tea cultivation helps to enhance the productivity of acidic soils, fighting erosion and runoff in South-Western regions. Economically, the government of Rwanda views the tea sector in the loop of increasing tea export volumes reaching 3% of the global market by 2024(NAEB, 2018).

Government policies for tea sector improvement started back in 1999 with a reform program that aimed to privatise the government-owned tea factories and plantations to stimulate investment in the sector while attracting foreign investment(Korman, 2008). The privatisation was accompanied by the introduction of a new green leaf pricing scheme to provide an incentive for tea growers in order to increase the quality of produced green tea leaf and production to meet the demand of installed tea factories in 2006. The tea expansion program of 2012-2017; which include planting new 18,000 ha of tea plantations (of which 10,000ha of new sites and construction of 5 new factories in South-West regions of the country were executed), was meant to boost the quality and productivity of tea farms as well as providing access to inputs by farmers and enhanced capacity building for farmers including ensuring better R&D efforts towards better high yielding clones of tea for farmers (NAEB, 2019). The above interventions have made high demand for tea credit, its utilisation remains necessary for intensive production and sector growth (Abedullah *et al.*, 2009; Bekun *et al.*, 2018).

Though the production of tea factories in Rwanda is still challenged by the small-scale tea production system by independent farmers who own 70% of total tea plantations, the situation is coupled with the rate of effective utilisation of agricultural credit obtained by farmers which remain suboptimal(Nair *et al.*, 2018). These observed critical cases are when farmers fully or partially divert credit from initial purpose to off-farm uses that affect the optimal production of green tea leaf and farmers' income (Bashiru *et al.*, 2014; Seyed *et al.*, 2017; Vedamurthy, 2014).

Available studies have been attached to limited determinants of financing the sector and the barriers to reaching the optimum tea farm investment such as limiting factors to borrow from formal sources for the desired size to raise tea investment by small scale farmers(Musabanganji *et al.*, 2015). Others analysed the farmers' participation in formal credit markets in rural areas of Rwanda(Muhongayire *et al.*, 2013) and availability and affordable financial services in rural areas (K. O. Fuglie & Bosch, 1995; Papias & Ganesan, 2010). However, an analytical tool for decoupling credit utilisation on the farm and non-farm investment is missing to give a comprehensive credit effect on farm income. There is also a need for a study that accounts for self-selection to measure the effect of utilisation of credit on tea income.

This study analysed the effect of credit utilisation on tea income among tea farming households in the Nyaruguru district in Southern Province, Rwanda. Furthermore, the study assessed whether credit utilisation is a viable strategy in increasing green tea leaf production thus tea farmer's income in the area.

5.1.1. Theoretical and analytical framework

It is important to understand how marginal effect by utilising credit was measured between non-diverted credit and diverted credit farmers who accessed credit for tea production purpose and how the endogeneity effect was controlled. For this purpose, the credit utilisation modelling is here referred to as the Random Utility Theory (RUT), which assumes that a farmer is a risk neutral and any made decision for allocating credit will influence the utility derived from credit utilisation. The same theory predicts that a farmer chooses to utilise credit on tea farm or non-tea farm uses based on the predicted risked or latent expected utility to gain. The examination is worked around the *anticipated* income from supplied green tea leaves as a function of credit utilised for tea production. Note that this function does not specify tea farm income as total working capital (Feder *et al.*, 1990; Huppi & Feder, 1990).

The issue of endogeneity in utilising credit results from the fact that besides the loan contract, a farmer's decision to utilise credit for the presented project remains one's choice (self-selection). Farmers choose to utilise credit for tea enterprise by taking into account (among other factors) the latent expected utility, here referred to as the benefit they can derive from it. It would be understood here by the gross income paid for supplied green tea leaves to the tea factories. The reliability of the selected econometric model to estimate the attribution of credit on farm income eventually relies upon its capacity to measure and control for *all* systematic differences between non-diverted credit and diverted credit farmers. One reason for questioning the adequacy of the econometric efforts is how likely the model can account for the relationship between credit use and unmeasurable factors by minimising the unobserved effects in the error term. For instance in the current investigation, beyond observables factors, unobservable variables such as skill levels, agricultural practices, technical know-how and soil quality, entrepreneurial ability, could also affect farm productivity and income. Therefore, in investigating the effect of utilising credit on tea farm productivity and farm income, it would be simplistic and biased to just attribute the differences in tea farm outcomes between two groups of farmers.

In experimental data, there would not be a problem of causal inference because the counterfactual situation is known (Miguel & Kremer, 2004). However, in the case of cross-sectional survey data, the counterfactual is not known which creates an issue to interpreting causal inference in such a situation. Misreading the situation by not controlling unobservable factors can lead to overestimate, underestimate or report the impact where none exists at all. These include types of social networks that are not captured such as the kind of neighbours the farmer speaks to and whether such neighbours had used credit. Second, transaction costs can be incurred by farmers because of poor access to inputs suppliers. Last but not least, innate managerial and technical abilities of optimally utilising available resources among others. This can justify the use of econometric models. The choice of an econometric model for investigating the implication of utilising credit on tea farm income is based on its capacity to account for potential endogeneity resulting from structural differences between characteristics of household farmers and technical efficiency they have adopted in their respective categories (Di Falco *et al.*, 2011).

The Endogenous Switching Regression (ESR) approach was developed by Greene (2002) and Lee (1977). It is a generalised Heckman's selection correction approach. It treats selectivity as an omitted variable problem(Heckman, 1979). Since the income from tea production is observed for both non-diverted credit and diverted credit farmers' groups, the switching regression approach separates farmers into two regimes based on their decision towards credit utilisation for tea production in order to capture the differential responses of the two groups. The ESR model addresses such endogeneity error by regressing simultaneously credit utilisation or selection and the farm income equation (Freeman *et al.*, 1998; W. H. Greene, 2002; Huppi & Feder, 1990) by using full information maximum likelihood approach suggested by Lokshin and Sajaia (2004).

The approach built in the model is able to disentangle the effect of credit from that generated by the difference in the observable and latent attributes of the non-diverted credit and diverted credit farmers (Greene, 2002; Lokshin & Sajaia, 2004). In this way, the study has considered the model for its capacity to account for self-selection and to measure the effect of credit utilised on generated income from tea production.

5.2. Materials and Methods
5.2.1. Data collection

The study used primary data collected through a farmers' survey. A stratified sampling technique to select tea farming households in the Nyaruguru district. The district was chosen purposively because tea production is amongst economic activities, employment and source of income in the area. The district has been also implementing the national tea expansion program since 2012 that aimed at increasing land size for tea production and rate of inputs application to meet the national targets for the sector.

Two cooperatives were purposively selected; Cooperative des Théiculteurs Nshili-Kivu [COTHENK] and Cooperative des Theiculteurs de Muganza-Kivu [COTHEMUKI] both have 3,445 members. These tea cooperatives are operating along Nyungwe National Park from the South-West to the North-West in the district of Nyaruguru.

From a population of 3,445 tea farming households of the two cooperatives; COTHENK with 2,560 and COOTHEMUKI with 885 farmers respectively, a total of 358 farmers was calculated

as the sample size for the survey interview of which 266 and 92 farmers were randomly selected from the two cooperatives respectively. The following formula of (Yamane, 1967)was used to calculate the sample from the population and the stratum respectively.

$n = \frac{N}{1+N(e)^2}$ and,

……………………………………………………………………………….(22)

$n_i = n\frac{N_i}{N}$

with, n = Estimated total sample size; N = Total population size; N_i=Total population size in the stratum; n_i = Estimated sample size in the stratum and, e = Represents the level of precision.

Tea farmers in each cooperative were further classified into two groups based on the records about credit utilisation performance from their respective cooperatives. The performance is typically evaluated as the rate in percentage at which a received credit was utilised for exclusively tea production. i.e., reported credit diversion or non-diversion cases. The stratified technique was to ensure the representation of targeted respondents in the specific strata.

Data collection activity used three methods; questionnaires to collect quantitative data from tea farmers, cooperatives' records and reports and key informants for additional information. The survey was conducted face-to-face to interviewing heads of the households. Quantitative data included the gross margin income from tea farms in Rwandan currency where its equivalent US dollar could be estimated at 950Frw per 1USD in the period of the survey.

Tea farmers in each cooperative were further classified into two groups based on their credit utilisation performance from records of their respective cooperatives. The performance was evaluated as the rate in percentage at which a received credit was utilised for exclusively tea production. i.e., reported credit diversion or non-diversion cases. The stratified technique was to ensure the representation of targeted respondents in the specific strata.

Data collection activity used three methods; questionnaires to collect quantitative data from tea farmers, cooperatives' records and reports and key informants for additional information. During the survey, a questionnaire was administered to randomly selected tea farmers. The survey was also conducted face-to-face to interviewing tea household representatives. Thereafter, the Endogenous Switching regression model was used to have empirical estimates.

5.2.2. Endogenous Switching Regression (ESR) model specification

The credit utilisation for the intended projects for a farmer is driven by projected gross margin under assumptions. Modelling the situation assumes that the utility (tea farm outcomes) a farmer i derives by allocating fully accessed credit for tea production or non-diverted credit is y_{NDC} and the utility when diverting credit for out of tea production or diverted credit is symbolised as y_{DC}.

The two groups of farmers can be expressed as;

$$y_{iNDC} = x_i \beta_{NDC} + \varepsilon_{iNDC} \text{ and,}$$
$$y_{iDC} = x_i \beta_{DC} + \varepsilon_{iDC}$$

$$\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{ (23)}$$

where, x_i is a vector of explanatory variables. β_{NDC} and β_{DC} are parameter estimates for non-diverted and diverted credit categories respectively. ε_{iNDC} and ε_{iDC} are independent and identically distributed error terms. Under random utility assumption, if utilising credit for tea enterprise a farmer expects to derive the higher gross margin, this case be expressed as $y_{iNDC} > y_{iDC}$. However, some determinants that influence the farmer's decision are unknown to the researcher. To account for selection and switching between two regimes, the endogenous switching regression model addresses the issue in two stages. The first is the selection model for utilising received credit for tea production or for alternative and competing uses. That is D_i^*, a latent variable determines which regime the tea household farmer faces:

$$D_i^* = \gamma_i z_i + u_i \ ; \ D_i = 1 \ if \ D_i^* > 0; \ D_i = 0 \ if \ D_i^* \leq 0 \qquad \dots\dots\dots\dots\dots\dots\dots\dots \text{ (24)}$$

where D_i is a binary variable that takes 1 value for non-diverted credit regime and zero value for diverted credit regime. γ_i is a vector of parameters to be estimated as the marginal effect of being in one of the two regimes. The error term u_i with mean zero and variance σ_ε^2 for measuring errors. Variables z_i as the independent instrument that includes unmeasured confounding factors and attributes that influence the decision of utilising credit for tea enterprise or not.

The second stage is the tea farm outcome (i.e., the number of green tea leaves produced) or farm income equation that split the endogenous model into two regimes (Z. Lokshin & Sajaia, 2004; Maddala, 1983). Following the arguments in the equation (24), description of the two regimes, farmers' category takes the following values:

Regime 1: Non-Diverted Credit (NDC): $y_{1i} = \beta_1 x_{1i} + \varepsilon_{1i}$ if $D_i = 1$

Regime 2: Diverted Credit (DC): $y_{2i} = \beta_2 x_{2i} + \varepsilon_{2i}$ if $D_i = 0$

$$\dots\dots\dots\dots\dots \text{ (25)}$$

Where y_{iNDC} and y_{iDC} are gross margins from non-diverted and diverted credit farmer's regimes respectively. x_{1i} and x_{2i} vectors of independent variables. β_1, β_2 and γ are parameters to be estimated. ε_{1i} and ε_{2i} are error terms for non-diverted and diverted credit farmers respectively. D_i is a dummy variable to distinguish two regimes. It measures endogenous to farm income y_i and to other exogenous variables x_i, which must be captured in the ESR model. The self-selection caused by the correlation of the error terms of the decision and the gross margin equations. Maddala (1983) explained that error term u_i is linked to the error terms $(\varepsilon_{1i}, \varepsilon_{2i})$ in Eq.25. The three errors are correlated and have a positive value i.e., corr $(u_i, \varepsilon_{1i}, \varepsilon_{2i}) \neq 0$. In the other words, the error terms u_i, ε_{1i} and ε_{2i} have a trivariate normal distribution, with mean vector zero and covariance matrix expressed as:

$$cov\ (u_i, \varepsilon_{1i}, \varepsilon_{2i}) \begin{bmatrix} \sigma_u^2 & \sigma_{u1} & \sigma_{u2} \\ \sigma_{1u} & \sigma_1^2 & \sigma_{12} \\ \sigma_{2u} & \sigma_{21} & \sigma_2^2 \end{bmatrix} \quad\text{...............................} (26)$$

Where the variance of the error terms in the selection equation and the two gross margin regimes 1 and 2 is denoted by σ_u^2, σ_1^2 and σ_2^2 respectively. Mathematically, this variance can be expressed as; $\sigma_u^2 = var(u_i)$; $\sigma_1^2 = var(\varepsilon_{1i})$ and $\sigma_2^2 = var(\varepsilon_{2i})$.

The covariance of the error terms from the selection equation u_i and the gross margin regimes $1(\varepsilon_{1i})$ and $2(\varepsilon_{2i})$ is respectively denoted by σ_{u1} and σ_{u2}. Mathematically, the respective covariance between error terms is expressed as; $\sigma_{u1} = var\ (u_i, \varepsilon_1)$ and $\sigma_{u2} = var(u_i, \varepsilon_2)$. However, as two outcome equations for two regimes i.e., y_{1i} and y_{2i} variables can never be observed simultaneously for a single tea farmer, the σ_{12} or σ_{21} in the covariance matrix is therefore not present (Maddala, 1983).

From the aforementioned equation (4), the values of the error terms for the two regimes $(\varepsilon_{1i}|D = 1)$ and $(\varepsilon_{2i}|D = 0)$ are different from zero. They estimated using probit in the first stage of the endogenous switching regression model (ESR) to produce Inverse Mill Ratios (IMR); λ_{1i} and λ_{2i} estimates (Greene, 2002) derived according to definitions in Eq.25 as follows:

$$E(\varepsilon_{1i}|D_i = 1) = E(\varepsilon_{1i}|u_i > -\gamma_i z_i) = \sigma_{1u} \left[\frac{\phi(\gamma_i z_i)}{\Phi(\gamma_i z_i)}\right] \equiv \sigma_{1u} \lambda_{1i}$$

$$E(\varepsilon_{2i}|D_i = 0) = E(\varepsilon_{2i}|u_i \leq -\gamma_i z_i) = \sigma_{2u} \left[\frac{-\phi(\gamma_i z_i)}{1 - \Phi(\gamma_i z_i)}\right] \equiv \sigma_{2u} \lambda_{2i} \quad\text{.......................}(27)$$

Where ϕ and Φ are the standard normal probability and cumulative distribution functions respectively. The ratio of ϕ and Φ evaluated at $\gamma_i z_i$ (Eq.6) is referred to as the Inverse Mills Ratio λ_{1i} and λ_{2i} (selectivity terms).

In the second stage of endogenous switching regression, the predicted variables in the Eq.27 are then added to the appropriate equation in Eq.25 to yield

$$y_{1i} = \beta_1 x_{1i} + \sigma_{1u}\lambda_{1i} + u_{1i} \qquad \text{if } D_i = 1 \text{ and,}$$
$$y_{2i} = \beta_2 x_{2i} + \sigma_{2u}\lambda_{2i} + u_{2i} \qquad \text{if } D_i = 0$$

$$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (28)$$

Where u_{1i} and u_{2i} have zero conditional means. The coefficients of the variables λ_{1i} and λ_{2i} provide estimates of the covariance terms σ_{1u} and σ_{2u} respectively. The difference of Inverse Mills Ratios between the two regimes is based on comparative advantage and would expect to be positive. i.e., $\sigma_{1u} - \sigma_{2u}{>}0$ to indicate that utilising credit for tea production would result from higher yield and gross margin than investing out of tea enterprise.

Since the interest is the evaluation of the effect of utilising credit on tea farm outcome (green tea leaves produced or gross margin), there is a need of assessing the treatment and heterogeneity effect on tea farm outcome. Lokshin and Sajaia suggested that full information maximum likelihood (FIML) is enough for regressing simultaneous equations for two regimes which is not the case for two-stage least squares. This approach estimates both the selection and tea farm income equations to obtain standard errors. The ***movestay*** command in the STATA 16 is sufficient to run the endogenous switching regression model (Lokshin & Sajaia, 2004).

The independent variables used in the Endogenous Switching Regression (ESR) model are presented in the following table 5.1 below.

Table 5.1Description of variables used in the Endogenous Switching Regression model

Independent variables	Definitions	Type of variable
Age	Years of household head	Continuous variable
Sex	Sex of the household head, 1=Male, 0=female	Dummy variable
Education	Years of schooling of the household head	Continuous variable
Household size	Number of people in households	Continuous variable

Experience in tea farming	Years in tea farming by a household head	Continuous variable
Training on GAP	Whether a household head received training on good agricultural practices (GAP), 1=Yes, 0=No	Dummy variable
Training on credit management	Whether a household head received training on credit management, 1=Yes, 0=No	Dummy variable
Tea plantation size	Owned tea plantations by a household in hectares	Continuous variable
Tea labour cost	Cost of hired labour tea farm activities in Rwandan francs	Continuous variable
Tea inputs cost	Cost of inputs used for tea production in Rwandan francs	
Type of accessed credit	Whether a household head has accessed to credit in group, 1=Yes, 0=No	Dummy variable
Credit constraint	Whether a household head has received a desired amount, 1=Yes, 0=No	Dummy variable
Off-tea farm income	Whether a household head has off-tea farm income, 1=Yes, 0=No	Dummy variable
Size of credit	The total value of approved credit per household in Rwandan francs	Continuous variable

The greater the coefficient in explanatory variables, the greater response on tea farm income by marginal changes as factor varies. The positive sign of estimated coefficients indicates the positive marginal effects on revenue from tea production.

The signs and significance of correlation coefficients (σ_{1u} and σ_{2u}) of the error terms from estimated two regimes' equations (treatment and outcome equations. i.e., Eq.27) have meaningful interpretation (Awotide *et al.*, 2015; Maddala, 1983). If either σ_{1u} or σ_{2u} is significantly different from zero there is endogenous switching which would result from the selection bias. If $\sigma > 0$ a negative selection bias is present. The interpretation of this would mean that tea farmers with below average gross margins are more likely to utilise credit for tea production. On other hand, if $\sigma < 0$ a positive selection bias is present meaning that tea farmers

with above average gross margins are more likely to utilise credit for tea production. Similarly, Fuglie and Rada (2013) argued that if both σ_{1u} or σ_{2u} coefficients have alternative signs, the credit utilisation choice is done based on comparative advantage; farmers who utilise credit for tea production earn above-average returns from utilisation and those who diverted credit earn above-average returns from alternative uses. On the other hand, if the coefficients have the same sign, farmers who utilise credit earn above-average returns whether they utilise credit for tea production or not, but they are better off by utilising credit for tea.

5.2.3. *Estimating treatment and heterogeneity effects on tea production and tea income*

The estimation of the average treatment effect on the treated (ATT) and untreated (ATU) is estimated using the aforementioned endogenous regression model results by comparing two groups. The observed values of tea farm income for non-diverted credit and diverted credit farmers' groups are computed as follows:

Non-Diverted Credit (NDC) observed in the sample: $[y_{1i}|D = 1] = \beta_1 x_{1i} + \sigma_{1u}\lambda_{1i}$ (29)

Diverted Credit (DC) observed in the sample: $[y_{2i}|D = 0] = \beta_2 x_{2i} + \sigma_{2u}\lambda_{2i}$ (30)

where $D = 1$ for the non-diversion case and $D = 0$ for the diversion case. y_{1i} and y_{2i} are tea farm income for non-diverted and diverted farmers' regimes respectively. In the same style, the counterfactual expected tea farm income for two groups is:

Non-diverted credit counterfactual $[y_{2i}|D = 1] = \beta_2 x_{1i} + \sigma_{2u}\lambda_{1i}$ ....(31)

Diverted credit counterfactual $[y_{1i}|D = 0] = \beta_1 x_{2i} + \sigma_{1u}\lambda_{2i}$ .... (32)

The average treated effect (ATT) of credit utilisation on tea farm income for non-diverted credit group is computed as the difference between equations (29) and (31) as follows:

$ATT = E[Y_{1i}|D = 1] - [y_{2i}|D = 1] = x_{1i}(\beta_1 - \beta_2) + (\sigma_{1u} - \sigma_{2u})\lambda_{1i}$ ....(33)

and the average treated effect (ATU) of credit utilisation on tea farm outcomes for diverted credit group (untreated) is computed as the difference between equations (32) and (30) as follows is:

$ATU = E[Y_{1i}|D = 0] - [y_{2i}|D = 0] = x_{2i}(\beta_1 - \beta_2) + (\sigma_{1u} - \sigma_{2u})\lambda_{2i}$..................... (34)

The base heterogeneity (BH) effects that refer to the differences in the tea farm outcomes due to the inherent differences besides tea production such as having other businesses and not that of the treatment can be computed. The heterogeneity effect for the non-diverted credit group is computed as the difference between equations (29) and (32),

$[y_{1i}|D = 1] - [y_{1i}|D = 0] = \beta_1(x_{1i} - x_{2i}) + \sigma_{1u}(\lambda_{1i} - \lambda_{2i})$ .... (35)

And that of the diverted credit group as the difference between equations (31) and (30),

$[y_{2i}|D = 1]\text{-}[y_{2i}|D = 0] = \beta_2(x_{1i} - x_{2i}) + \sigma_{2u}(\lambda_{1i} - \lambda_{2i})$ ………………..…………. (13)

Finally, transitional heterogeneity (TH) is estimated as if the effect of utilising credit is larger or smaller for the farmers that actually utilised credit for tea production or for the farmers that actually diverted credit in the counterfactual case. That is the difference between equations (33) and (34); i.e., (ATT) and (ATU).

5.3. Results and discussions

5.3.1. Characteristics and descriptive statistics of the respondents

The age of the respondent is positive and significant at a 5 per cent level (Table14). This implies that farmer's age is positively correlated with credit utilisation decision. This also shows that older farmers are upright in utilising credit for tea production than youth as they are risk averse to venture for income diversification (Langyintuo & Mekuria, 2005).

In the results (Table 5.2), the mean difference of size of tea plantation owned was found to be no significant between the two groups of household farmers. This is possible because tea plantation is a long-term cycle plant, and its production can be improved by using input fertilisers and technical efficiency(Nguyen-Van & To-The, 2016). The mean difference of labour cost is significant at a 5 per cent level indicating that credit users for tea production invest Frw 65,507 per hectare more than that of diverting credit. Similarly, input fertiliser with a significant mean difference (at a 1 per cent) of Frw 52,495 per hectare indicating that non-diverted credit users for tea production invest more than their counterpart diverted credit users. The size of credit accessed is also significant at a 1 per cent level indicating that farmers who divert credit to off-farm investment have averagely accessed Frw 249,067 more amount than uprightness group that utilise credit for intended tea projects. The explanation is that having off-farm income can reduce the perception of risk for lending institutions especially when borrowers can show different repayment options (Awotide *et al.*, 2015).

Income from tea production was found to have an aggregated mean of Frw 881,827 per hectare per quarter. However, farmers who divert credit to off-tea farm investment earn income (significant at 5 per cent) less than (Frw 416,045) that of utilising credit for tea production. The result is empirically argued that higher farm income improves technical efficiency and capacity to jumpstart agricultural innovation(Amsalu & de Graaff, 2007). Other farmers' characteristics such as the level of education and gender of the household head, the size of household and experience in tea farming; are not significant for both of the two farmers' categories.

Table 5.2Tea household farmers' characteristics for continuous variables (t-Statistic)

	Mean difference of tea household characteristics by farmer's regime			
Continuous variables	NDC (n=209) Mean	DC(n=149) Mean	Mean difference	*t*-Statistic
Age of HH (years)	53.23(0.84)	50.52	2.71	-2.1440**
Education of HH (years)	5.23(0.30)	5.32 (0.35)	0.09(0.46)	0.1869
Size of HH (no. of dependents)	6(0.14)	6(0.15)	0.20(0.20)	0.9566
Experience of HH in tea farming (years)	7.23	7.40	0.17	0.7164
Size of tea plantation (Ha)	0.99(0.06)	0.89(0.07)	0.10(0.09)	-1.1422
Tea labour cost (Frw/ha/quarter)	177,978.4 (21,490.76)	112,470.7 (16,839.21)	65,507 (29,159.6)	-2.2465**
Tea input cost (Frw/ha/quarter)	140,162.8 (13,770.72)	87,668.08 (9,958.21)	52,494.69 (18,352.84)	-2.8603***
Size of credit accessed (Frw)	370,411 (37,546)	619,478 (68,009)	-249,067 (72,613)	3.4300***
Tea farm income (Frw/ha/quarter)	881,827 (131,772)	465,782 (83,791)	416,045 (171,392)	2.4274**

***1% level of significance; **5% level of significance; *10% level of significance

The females constitute a minority in both farmers' regimes (Table 5.3). Males represent 83.7% and 81.2% of non-diverted and diverted farmers' categories respectively while females represent 16.2% and 18.8% respectively. However, the chi-square test shows no association between the gender of the household head and credit utilisation decision.

The results show also that among farmers who accessed credit in groups, around 60.3% have utilised credit for tea production while 44.3% of them have diverted credit. The chi-square test is significant indicating that disbursement of credit in groups has a positive association with farmers' decision when utilising credit. The results were supported that borrowing in the group itself increases bargaining power for members upon presenting collective responsibility while reducing the perception of repayment risk (Shiferaw *et al.*, 2014). Specifically, farmers who accessed the credit of input fertilisers that are channelled through farmers' cooperatives are likely utilising them for intended projects because of close supervision of the group leaders compared to their counterparts who individually accessed the credit.

The result for borrowing status revealed that household farmers were not constrained at 80.7%, which means that they had received desired credit amount. Out of them, 75.1% have utilised accessed credit for intended tea projects while 88.6 % have diverted credit to off-farm uses. The chi-square test is positively significant indicating that there is an association between accessed amount and credit utilisation decision of farmers.

Table 5.3 Tea household farmers' characteristics for discrete dummy variables (Chi2test)

Dummy variables	Sample	NDC (n=209)	DC(n=149)	χ^2
		%	%	
Gender (Male=1)	82.68	83.73	81.21	0.3870
(Female=0)	17.32	16.27	18.79	
Credit groups (Yes=1)	53.63	60.29	44.30	8.9454***
Credit non-constrained (Yes=1)	80.73	75.12	88.59	10.1454***
Training on tea GAP (Yes=1)	87.71	93.30	79.87	14.5664***
Training on credit management (Yes=1)	24.02	26.79	20.8	2.1140
Off-tea farm income activities (Yes=1)	45.81	28.71	71.50	59.1634***

***1% level of significance; **5% level of significance; *10% level of significance

The adoption of agricultural practices (GAP) is significant indicating its influence on how farmers utilising credit for tea production. Around 93.3% and 89.9% of non-diverted and diverted farmers' groups respectively have participated in organised training on good agricultural practices (GAP). Training on credit use and credit management offered by formal lending institutions to tea farmers was not significant to influence the decision of farmers for credit utilisation. The results also show that there is a positive and significant association between running off-tea farm businesses and farmers' decision for credit utilisation. Statistically, only 28.7% of farmers that having off-tea businesses have utilised credit to objectively intended tea projects while 71.5% have preferred to invest accessed credit out of tea enterprise. The positive association between credit diversion from intended project to off-farm businesses have been empirically highlighted in various contexts. Similarly, Hussan (2012) and Oboh and Ekpebu (2011) argued that farmers divert credit to either diversify income

or risk mitigation. As management, training on loan management and regular visit of bank supervisors to credit beneficiaries were highly recommended for some cases in Nigeria and Pakistan.

5.3.2. Effect of credit utilisation on the tea farm income and factors influencing gross margins

The results of endogenous switching regression using full information maximum likelihood are presented in the table 5.4. The first column presents the estimated coefficients of the selection equation on utilisation of credit for tea production or diverted to out of tea farm uses. The next two columns (second and third) present the estimated coefficients of the outcome equations of tea farm income for the two regimes of farmers as non-diverted and diverted groups or if you want, they are credit users and credit non-users of credit for tea projects respectively.

Factors influencing tea farm income

Turning to the results, the estimates of the first stage of the Endogenous Switching Regression (ESR) model presented in Table 5.4 The variables used in the estimation are various farm and household characteristics and institutional variables that are associated with credit utilisation. The dependent variable is the logarithm of income from owned tea plantations calculated as the price per kilogram paid by a processing tea factory multiplied by the total quantity (in kilogram) of supplied green tea leaves.

The Wald χ^2 the test statistic is highly significant indicating the goodness of fit of our ESR model (*p-value=0.000)*. The likelihood ratio test (14.35) of independence of selection and tea farm outcome equations is statistically significant at 1 per cent (*p<0.000*) suggesting that the ESR model variables are jointly validated as strong predictors for credit utilisation. An interesting finding is the signs and significance of the covariance terms (ρ_U and ρ_{NU}). The correlation coefficient $\boldsymbol{\rho_{U\varepsilon}}$ indicates the correlation between credit utilisation situation and its effect on tea farm outcomes by non-diverted credit users. While the correlation coefficient $\boldsymbol{\rho_{NU\varepsilon}}$ indicates the correlation between credit utilisation situation and its effect on tea farm outcomes by diverted credit users.

The results show that the covariance terms for both regimes are all statistically significant, indicating that the self-selection occurred in credit utilisation decision. Thus, utilising credit

for tea production may not have the same effect on those who divert credit, if they choose to utilise it for tea projects as well. Moreover, having the same signs, positive and statistically significant for both farmers' categories implies that utilising credit has a significant positive effect on farm outcomes (yields and net returns), thus credit user farmers obtained higher yields and net returns than a random individual from the sample would obtain. This is also confirmed since the necessary conditions for consistency are fulfilled ($\rho_U > \rho_{NU}$) indicating that credit users for tea production obtain a higher outcome than they would if they deviate credit to off tea uses.

The ESR estimates (Table5.4) show that the positive and significant variables of gross margins for non-diverted credit farmers' group are: age, size of tea plantation, experience in tea farming, training on good agricultural practices, visits of lending institutions officers for monitoring, the cost of hired labour and input fertilisers. For diverted credit farmers' group, significant variables include the size of tea plantation, experience in tea farming, training on tea good agricultural practices, training on credit use and management, cost of hired labour and input fertilisers as well.

Table 5.4Endogenous switching regression results for credit utilisation and tea farm output equations (in ln of income)

Variables	Selection	Gross margins	
		NDC	DC
Constant	7.374 (1.110)	10.223(0.574)	9.485(0.625)
Tea farm income[11]	708,668	881,827	465,781
Gender	-0.045(0.208)	-0.024(0.204)	0.113(0.221)
Age	0.009(0.007)	0.013*(0.008)	0.009(0.007)
Education	0.018(0.020)	-0.028(0.020)	0.013(0.020)
Tea plantation size	0.112(0.103)	0.454***(0.106)	0.328***(0.109)
Experience in tea farming	-0.040(0.040)	0.084**(0.038)	0.071*(0.040)
Credit non-constant	-0.240(0.221)	-0.265(0.263)	0.150(0.196)
Training on GAP[12]	0.965***(0.254)	0.483**(0.220)	0.822**(0.350)
Training on credit Mgt	0.758***(0.221)	0.327(0.221)	0.466**(0.198)

[11] Income was calculated as Rwandan francs per Ha at the exchange rate of 950 / USD
[12] Look for "diversion conclusion on Summary-desktop" Pakistan case

Lending fin. visits	-0.145(0.175)	0.384**(0.176)	0.064(0.170)
Tea labour cost	0.340***(0.068)	0.127*(0.070)	0.170***(0.051)
Tea input cost	0.317***(0.091)	0.245***(0.090)	0.180***(0.059)
Credit size	-0.711***(0.096)		
Off-tea farm businesses	-0.892***(0.167)		
Credit groups	0.500***(0.157)		
$ln\sigma_U$		-0.012(0.066)	
$\rho_{U\varepsilon}$		0.545***(0.176)	
$ln\sigma_{NU}$			0.157(0.057)
$\rho_{NU\varepsilon}$			0.467**(0.194)

Log likelihood	-684.21
Wald test (**11**) Prob>chi2=0.0000	117.10
LR test of Indep. Eqns. $\chi^2(\mathbf{1})$=14.35 Prob>chi2=0.0008	14.35***

***1% level of significance; **5% level of significance; *10% level of significance*

Age has a positive impact on tea farm income for tea credit users. Association of age with tea income implies that older people may be more risk-averse and reluctant to start off-farm ventures than younger people who are risk-takers. Therefore, there is a low rate of tea credit diversion to off-tea production projects for elder people. The finding is in line with the findings of Adego *et al.* (2019).

The investment for tea production is used as a proxy of credit utilisation by obtaining inputs, hiring labour and all related inputs to produce green tea leaf. The results show that the size of the owned tea plantation is significantly associated with tea farm income for both farmers' regimes *citeris paribus*. A 1% increase in credit to purchase one hectare for increasing tea plantation leads to an increase in income for non-diverted credit and diverted credit farmers at 45.4% and 32.8% respectively other factors held constant. This means that the volume of fresh tea leaves produced may be primarily dependent on the size of the tea plantations owned by a farmer. The results are in line with other findings that farm size is simultaneously an input factor and determinant of technical efficiency(Alvarez & Arias, 2003). Similarly, Bidzakin *et al.* (2019) showed this association between the size of arable land and farm productivity.

The number of years in tea farming is linearly correlated with tea income for non-diverted credit and diverted credit farmers at 5 and 10 per cent level respectively. This suggests that farmers' experience is related to the technical efficiency of tea production that results from using credit accessed to procure farm inputs and labour for tea maintenance activities. The results are supported by Maniriho and Bizoza (2018)who showed that tea is a long-term cycle plant and its production can be improved by using input fertilisers and cumulative technical efficiency especially know how to harvest qualitative green leaves during plucking.

Training sessions on good agricultural practices for tea production is a positive and significant determinant for tea income for both farmers' regimes. The results are plausible because technical efficiency is interconnected with the level of gained knowledge and skills by a farmer. Therefore, it is not surprising that tea production is likely increased when farmers apply skills and knowledge acquired from attended training as supported by Muzari *et al.* (2012). However, training on credit management has no influence on gross margins for non-diverted credit users. The finding shows that financial literacy is positive and significant for non-diverted credit users. This is probably because borrowing from formal sources requires one to have a certain level of knowledge on credit management specifically to minimise credit defaulting cases.

The findings also show that visits of officers from formal lending institutions are positively significant for effective credit utilisation in particular for credit users. This is probably possible because this category of farmers spends a maximum of their time on tea farm production activities and in most case, they live nearby tea production areas. The finding is supported by Oboh and Ekpebu (2011) who found that that the farmers visited by bank officials tend to assign more funds to the farm to mean that the absence of such regular visits tends to tempt farmers to divert credit to unintended uses.

The cost of hired labour is positive and linearly correlated with the farm yield in both categories. A 1% increase in credit to pay for supplementary man-day leads to 17% increasing income for the group of farmers that usually diverted credit to off-farm uses. The higher significant labour cost for this group implies the cost of delegating farm managers by landlords as these are busy for other businesses comparing to their counterparts whose tea production is a daily and primary occupation. Therefore, close management of hired labour for tea plucking determine the amount of credit to allocate for labour which is the case for tea credit users whose daily and primary occupation are tea farm production activities. However, the cost of input

fertilisers is positive and significant at a 1% level for both farmers' regimes because they are procured and supplied in bulk through the cooperatives if farmers have to benefit from the subsidiary program for fertilisers by the central government. Similar to other findings, it was also expected that employment of more farm input fertilisers increases with tea plantation size which is also significant to influence tea income thus increase the size of tea plantations require additional capital for purchasing inputs (Emerole *et al.*, 2007; Oboh & Ekpebu, 2011).

Determinant of tea credit utilisation

The endogenous Switching Regression (ESR) estimates show that the positive and significant variables of credit utilisation for tea production are; good agricultural practices, training on credit use and management, cost of labour and input fertilisers and access to joint/group credit. The significant and negative factors are; the size of accessed credit and possession of off-farm businesses. The results confirm that farmers' participation in various training sessions increases their commitment and determines the farmer's ability to allocate accessed credit (Caswell *et al.*, 2001). Like explained above, labour for tea maintenance and plucking activities demand more capital for a farmer thus a higher probability of using accessed credit for tea production. The cost of input fertilisers also plays an important role to influence the farmers' decision for credit allocation. Farmers with the higher cost of tea production are more likely to utilise accessed credit in purchasing related farm inputs.

Access to credit through farmers' cooperatives is positively significant at a 1% level for both farmers' regimes. This is possible because farmers are recommended to procure subsidised fertilisers in bulk through their organisations through the government subsidy program for fertilisers. This supply chain approach is monitored by cooperative leaders who have the voice in determining the farmer' eligibility for the credit scheme based on his/her farm size and past performance on utilisation. In most cases, the received fertilisers are later paid by deducting the amount on supplied green tea leaves at the level of tea factories and farmers receive the balance.

Factors like size of credit amount and off-farm businesses are significant and negatively affecting the farmer's decision of utilising credit for tea production projects and the level of tea farm income. Possession of off-farm businesses is here referred to as a proxy of all possible sources of income out of tea enterprise. These include trading businesses or salaried jobs etc. Significantly, our expected negative effect of off-farm businesses on credit utilisation for

intended projects is a result of endogeneity between agricultural production and off-farm businesses investment as income diversification strategy indicated by Musafiri and Sjölander (2018). Farmers can also present tea plantations as a collateral asset to access credit from formal lending sources mostly commercial banks and microfinance and later use it out of tea enterprise. Other factors are not significant and inconclusive to affect the decision of farmers to credit utilisation.

The effect of utilising credits on tea farm income: ESR

As shown in Table 5.5, the impact of credit utilisation for tea production is determined by differentiating the column of non-diverted credit and diverted credit farmers. Cells (a) and (b) represent the expected tea income observed in the sample. The results reveal that the utilisation of credit increases income for non-diverted credit farmers compared with diverted credit users. The expected mean income per hectare per quarter for a tea household farmer that utilised credit for tea production is about 969,155 Rwandan francs, while it is about 563,714 Rwandan francs for those who diverted credit. Therefore, those who objectively invest in tea production earn about 405,441 Rwandan francs (72 per cent) more than those who divert credit. The last column of the table (5.5) represents the treatment effect. For the counterfactual (c) case, tea household farmers who actually utilise credit gain 62,930 Rwandan francs (that is about 7 per cent) more than if they diverted credit. While for counterfactual (d) case, tea household farmers that diverted credit would have realised about 312,411Rwandan francs (that is about 55%) more than if they utilise credit for intended projects for tea production.

Table 5.5Impact of credit utilisation on the tea farm income

	Utilisation decision		
Utilisation status	Utilised	Diverted	Utilisation effect
Tea HH farmers who utilised credit	(a)969,155	(c)906,224	ATT=62,930
Tea HH farmers who diverted credit	(d)876,125	(b)563,714	ATU=312,410***
Heterogeneity effect	93,030	342,510	TH=-249,480

The credit has a significant and positive impact on farm outcomes if farmers effectively use it for tea production purpose. The estimates show that those who diverted credit would averagely increase the gross margins by 55 per cent. These results are particularly important to design

effective credit utilisation strategies to cope with the potential impacts of tea production change. The findings are consistent with the literature that credit has a positive and significant impact on farm yields and income (Awotide *et al.*, 2015; Iddrisu *et al.*, 2017; PONGUANE, 2016; Riaz *et al.*, 2012).

5.4. Conclusion and Conclusion

The specific objective of the study was to analyse the effect of credit utilisation on tea farm income and to assess whether credit utilisation is a viable strategy in increasing green tea leaf production in the study area. The study employed purposive and random techniques to collect data through an interview survey for tea farming households.

The results revealed that credit employment has a positive effect on tea production and income. Tea farming households who utilised credits for intended tea production had earned at 7 per cent more than if they diverted credit. While their counterparts who diverted credit could earn around 55 per cent if they choose to utilise credits for tea production purpose. Factors that are influencing the effective utilisation of tea credits in the area include age, size of owned tea plantation, experience in tea farming, training on good agricultural practices and credit management, visits of bank officials, rate of input fertiliser application, labour and if credits are channelised through farmers' groups as well. Furthermore, credits in cash and possession of off-farm businesses increased the rate of credits embezzlement and the level of tea farm income.

There is a need to make sure that all agricultural credit be utilised for the same purpose for which it was obtained. To reach there, policies and programs would enhance the provision of agricultural credit in kind mainly as physical inputs and be channelised through farmers' cooperatives to discourage credit diversion.

Notes

1. Tea gross margins were estimated as the amount in Rwandan Francs (exchange rate stood at US\$ 1.00=FRW 950.00 July 2019) paid for supplied tea-green leaves by a farmer per hectare per quarter.

2. Interested readers can consult the Access to Finance, Rwanda and Agro-input subsidy program by the government of Rwanda.

CHAPTER SIX

GENERAL DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

6.1.General Discussion

The importance of rural development, the impact of the agricultural investment on-farm outputs and the implication of a significant proportion of the small-scale households in the agricultural activities have been occupied most of the discussion among government, policymakers, academicians-researchers-scholars and international organisations for developing countries in particular Sub-Sahara African region. In the empirical-based studies, the authors' motivation was to provide evidence for the public interests on urgent actions and interventions to enhance the capacity of the agricultural population in the higher percentage who feed the majority of families while shaping the life standard in rural areas(Nair *et al.*, 2018; Pourmonazah, 2015; Sagbo, 2019; Yasmeen *et al.*, 2011). Some authors argued that the impact of utilisation and improved management of the available input resources on farm productivity and farm income ultimately depend on how these were economically utilised for intended projects by participants (M.-A. Abdul-Jalil, 2015; Ayegba Ojonugwa, 2013; Hancock, 2015; Riaz *et al.*, 2012).

Intensive agricultural production that demands a high volume of inputs and labour to meet fixed targets like exports volume, development of crop value chain requires an inclusive strategy that can improve the good management of the available resources at the farm level. For this study case in Rwanda, the government efforts for tea value chain development remain among priorities in the agriculture sector to improve not only the livelihood status of the tea farming households whose major source of income is from increasing the volume of green tea leaves but also tea factories' production and therefore tea exports growth in general(FAO, 2015; Ninsiima & Chung, 2016; Tewari & Hiraizumi, 2004). The Rwandan government policies on increasing the access of financial services, increasing the rate of input fertiliser application, expanding land for tea development and adoption of high yielding clones by tea-farming households are amongst priorities to increase *"made tea"* exports and income for farmers(NAEB, 2013). Upgrading the farm output is however a result of important investment for inputs, technology, and know-how skills that smallholder farmers have acquired. The major implication of the results from this study is that, if daily efforts of tea-farming households determine the operations and production of tea factories that are depending on supplies of green tea leaf while remains suboptimal (nearly at 69% of their full capacities) to reach the national

targets for tea exports(NAEB, 2013; Nair *et al.*, 2018) the envisioned interventions must respond to the conditions that affect tea farm outputs. These involve how to improve the effective utilisation of the tea credits for planned tea production projects. Therefore, the study was to reveal the responsible factors of utilising tea credits and their implication on tea farm outputs and income to inform policymakers and stakeholders.

Preliminary findings showed that the Rwandan tea production system has common features with other tea producing countries that the sector remains the largest employer for agricultural households. The review indicates that the majority of tea producers are the small-scale tea-farming households in China, Sri Lanka and Kenya, which together account for almost 50% of worldwide tea production(Solidaridad, 2020). In the region, tea acreage owned by small-scale accounts for more than 60% in Kenya and Uganda(Matsiko, 2019; Nyabwengi, 2017) while around 50% of total land allocated for tea production is owned by smallholders in Tanzania(John Baffes, 2004). In Rwanda, more than 70% of total tea plantations belong to small-scale household farmers (World Bank, 2018). Since this important representation of people in the sector resides in the rural areas, the implication is that policies and interventions to improve the tea production system have also to adopt a sustainable rural livelihood approach proposed by Li *et al.* (2021) that considers the ability to combine livelihood resources (tangible and intangible capital) that individuals possess − which is also resulting from natural, economic and social attributes − that determine the right to choose, and engage in, a certain range of activities to achieve different livelihood outcomes. This reflects how tea farming households' capacity and or how their behaviour is accommodated in the value chain development and implementation strategies. For instance, the operations and installation of tea factories must be within the smallest radial distance since the processing of supplied green tea leaf must be done a few hours of plucking to maintain the quality of made tea. On the other side, the effort on the inclusion of smallholder producers into tea factories' shareholders has a positive implication in the management of available inputs, funds and adoption of modern techniques for tea production(Thorpe & Maestre, 2015).

Generally, the results on the characteristics of sampled household tea farmers showed that most of them are male-headed and relatively large family sizes. The results are in the line with the national household survey report (EICV 4&5) by the National Institute of Statistics of Rwanda (NISR) that men dominate rural Rwandan household decision making and averagely rural families have six members per household. A significant proportion of Rwandan people in rural

areas have relatively low education levels, hardly completed primary level(NISR, 2016). The results on household tea farmers' characteristics have implication bearing on the credit products and financial services that could be designed for this category of borrowers either by simplifying application procedures and adjusting borrowing transaction cost. There is also a need for complementary training on credit management and formalised follow-up mechanisms to ensure that accessed credits are effectively utilised for intended projects.

The estimates of the multivariate probit for the objective one was to reveal the responsible factors that are influencing farmers' behaviour to choose and utilise types of lending sources available for borrowing in the study area. The credit sources utilised by tea farming households (chapter three) are of the two types as formal and informal lending sectors. Informal sources represented the majority to serve tea farmers for credit at 81.0% while formal sources were represented at 31.3%. The predominance of the informal sources for rural and small-scale farmers with relatively low income is widely found to have implication in different contexts due to the complex lending mechanisms of formal sources (Pham & Lensink, 2007; Tang & Guo, 2017; Waje, 2020). In the study area, tea cooperatives are mostly dominating other formal and informal lending sources for tea farmers.

The share of the tea cooperatives in the informal sector has also implication in the study area. This is because tea credits are channelised through tea cooperatives and most of the time, cooperatives procure input fertilisers in bulk for the members which reduce the price of inputs and timely distribution. This form of credits in kind are almost free of interest and mostly paid later by deducting a certain amount from supplied green tea leaf to the factories by these farmers. Providing inputs as credits is much attractive for inputs dealers and the government to reach the farmers for subsidised inputs and while reducing distribution cost. Tea cooperatives can borrow large credits from formal banks on behalf of members that will further be paid upon paid by tea factories for supplied green tea leaves. Furthermore, tea cooperatives are competitive in the area because they are community-based organisations and borrowing cost is fairy minimised for members(IPAR & AFR, 2018; World Bank, 2018). Most important, tea farming households maintain informal borrowing networks between themselves as they often belong to the rotating saving and credit groups within their closest areas.

The situation is against the general practices of private money lenders who usually control informal lending mechanisms by charging exorbitant rates for borrowers and in some cases,

they extract economic surplus provided by farmworkers, capital and probably land (Adebayo & Adeola, 2008; Von-Pischike, 1991). The results also provide a slight difference to the previous conclusion that smallholder farmers and low-income earners turn to the informal sources because they are always credit-constrained from formal financial institutions (Papias, 2008; Tang & Guo, 2017) or that collateral is frequently lacking or unsatisfactory for poor borrowers(Augustin, 2012).

To some authors, borrowing from informal sources presents additional advantages in particular when informal lenders can access keen information on the attitudes and repayment ability of borrowers which may increase trust between market players. Hence, the collateral requirement has a minimum role in borrowing though it is asked which is different for commercial banks where financial security is obligatory (Ijioma & Osondu, 2015; Kofarmata *et al.*, 2016). Some other studies like that of Karaivanov and Kessler (2018)revealed that when social capital is sufficiently large, informal credits carry lower interest rates and collateral and possibly, these tend to zero than for formal credits. The truth and the most reason for predominantly utilising informal sources are due to the government program of distributing subsidised input fertilisers that are channelised through the farmers' organisations in particular, where aggregated inputs are procured in bulk and further distributed as credits to the members like in tea sector. The loaning of inputs' approach through tea cooperatives is supported by the government for not only controlling utilisation of subsidised inputs but also empowering farmers' organisations by reducing transaction and transportation costs which was a burden for individually procurement (Chinsinga, 2015; Chirwa & Dorward, 2013).

The results read in part that tea farming households also combined formal and informal sources of credits (averagely at 86%) for various reasons. The combination of sources for borrowing has been motivated in different studies that are due to the lack and limited presence of commercial banks services in the rural areas coupled with delay in approval and disbursement of credit (Oshaji, 2018). Besides, lack of perfect information about their borrowers and persistence on collateral security as a prerequisite for credit acquisition discouraged debtors(Ijioma & Osondu, 2015); risk of losing collateral assets in case of failed businesses, a defaulter may borrow from one lender to pay another for the existing loan(Augustin, 2012), all these are behind of maintaining the connection with informal sources even if borrowers may not be credit constrained in the formal lending sources.

The results are also supported by Conning & Udry, (2007) who argued that the formal lending sector does not necessarily consider the nature and seasons of the agricultural activities like harvesting and crop sales periods when fixing repayment period which is discouraging borrowers. In the study by Serge-Adjognon *et al.* (2017) they had early observed that a near absence or inefficient formal financial lending mechanisms, farmers turn to informal sources as an alternative solution to get credits such as input brokers, in-kind or in cash. Furthermore, the results are strongly consistent that in most of the less developed countries like Rwanda, the reason behind combining lending sources is that farmers are normally risk-averse as they do not have any collateral securities as revealed by Augustin (2012).

The other factors for tea farming households to utilise formal credit sources include the size of the household, having valued collateral and charged an interest rate. The influence of household size to borrow from formal financial institutions is linked mainly to the associated level of the needs and expenses as indicated by Ijioma and Osondu (2015). He observed that in a bid to satisfy the increased household needs, a relatively high amount of credit will be acquired. It was also argued that the demand for credit is relatively high when a family has a high number of children of educational age who will need school fees and related expenses (Augustin, 2012). Also, Karaivanov and Kessler (2018) claimed that despite the relative discouraging transaction cost which is high to borrow from formal sources, the demand for credit is strictly positive when the ratio of the credit size to household borrower's wealth is relatively high. However, the results have not found the difference for other terms of the contract to borrow in the formal sources from previous studies(Karaivanov & Kessler, 2018; Zander, 2019). To get the desired credit amount, the value of the collateral and the level of the interest rate remain important factors to influence borrowing decision. As such, the effective number of tea farming households utilise formal lending sources because they can meet this requirement(Hussan, 2012).

Factors that influence borrowing from informal credit sources include farmers' membership in the cooperatives, families, practical training on tea production techniques, joint credits and distributed in kind as input fertilisers and the size of owned tea plantations as well. Similar to the factors that were already identified in previous studies like that of Adebayo and Adeola (2008) and Ijioma and Osondu (2015). According to Tang and Guo (2017), families with relatively low-income tend to mostly use informal credit sources like tontines, friends and relatives within families that are very practical and flexible for short and small credits with the

relatively low transaction in rural areas. The other advantage of borrowing in groups is that the personal responsibility of farmers in groups serves as collateral to obtain credits as the loan contract engages every member of the group to pay for a defaulter's loan share in case he or she is incapable to pay back the loan.

The fractional logit regression for objective two was used to estimate the extent to which tea credits were utilised for tea production and responsible factors in the study area. The observed rate of diverting credit to off-tea production (41.6%) was not a surprise among the rural and small-scale farmers. The study highlighted two major factors; off-tea farm businesses and the size of credit obtained. The implication is that some tea farmers may not consider tea production as their main activity for income to meet substantial needs within the household as claimed by the United Nations (2007). However, it is common for some authors that rural agricultural population do not use credit for the same purpose for which it was obtained which result in agricultural backwardness and poor loan repayment (Hussan, 2012; Isitor *et al.*, 2014).

The study found that for tea credits granted in cash with a relatively large amount, farmers had diverted credit from tea production projects to other off farm uses for different reasons. Besides economic constraints, some studies showed that household farmers have always natural and social attributes that determine access to the living needs as food and good health therefore, in utilising resources they have the right to choose, and engage in, a certain range of activities with high utility as a proxy of the degree of satisfaction (Ellis, 2000; *et al.*, 2021; Scoones, 1998). Other studies also reported that risk mitigation and need to sustain life is amongst preoccupation of the rural household families, the situation that makes them be net food buyers, in particular, with the tea production areas where food crops integration is not possible(Behrouz *et al.*, 2012; Oboh & Ekpebu, 2011). On the other side, (Serge Adjognon *et al.*, 2017) supported that off-farm income activities are important and need capital investment as well and, in some case, farmers finance farm inputs purchases with cash from non-farm activities and produce sales therefore, off-farm investment remains important for some agricultural population whatever source could be used (Serge Adjognon *et al.*, 2017; World Bank, 2017).

The current study informed that the informal lending sector led by tea farmers' cooperatives plays a direct and substantial role in credits performance and effective utilisation for tea production in the study area. They inspire the need for and importance of proper management of credits obtained to improve the quality of tea through practical training on tea production

techniques and management of contracts for credits granted by formal lending sources. This lending mechanism was found effective for effective utilisation of the credits for intended tea production projects as they are distributed to the members in the form of input fertilisers.

However, it claimed assurance of good management of the cooperative as was reported byNAEB (2013&2017b) that mismanagement of the credits was more engendered by the poor management of the cooperatives than members. Other reasons for farmers to divert credits from intended projects to off-fam uses include hidden relationship and social networks between some credit user farmers and cooperative leaders(Huppi & Feder, 1990), limited managerial skills for the cooperative leaders and hidden corruptions, lack of perfect information about borrowers (tea cooperative members) coupled the inability of lending institutions to have close monitoring are amongst causes of the high rate of loan diversion (Alio *et al.*, 2018; Papias & Ganesan, 2010; World Bank, 2018). Generally, factors like group credits while being non-constrained, hands-on practice and credit management training had influenced positive the utilisation of obtained credit for the right presented projects. These factors often engage the physical participation of the farmers in agricultural activities which also increase the motivation to increase farm investment as the results are immediately observed from the released farm outputs.

The positive impact of the credit on tea farm outputs was also evaluated using the endogenous switching regression model. The estimates have validated our expected causal relationship that there is a positive association between credit amount invested for tea production and farm income. The results indicated that the causal effect of the credits utilised on the farm income was positive for two categories of tea farming households though at different levels. Farmers who effectively utilised received credits for planned tea production projects have increased income at the rate of 7% more than if they would choose to utilised credits for out of the farms. The potential effect for those who diverted credits could reach 55% if the obtained credits were effectively used for tea production. The findings concur with many conducted studies that found a positive effect of credit (Awotide *et al.*, 2015; Riaz *et al.*, 2012). In line with this, different researchers reported that credit is an input factor and determinant of technical efficiency as it enables farmers to acquire necessary farm inputs and technology to improve production (Iddrisu *et al.*, 2017; PONGUANE, 2016). In the study area, two major factors were found more competing with tea production for accessed tea credits utilisation among households. The rate of credit diversion high when a farmer received large credits and in

particular distributed in cash. On the other side, it was found that granted credits in kind as input fertilisers that are channelised through cooperatives were utilised for presented projects at a good rate. Saba *et al.* (2012) reported the role and benefits of the farmers' groups for effective utilisation of credits that minimise the transaction cost that would occur for an individual borrowing and provide unquestionable guarantee for the future borrowing decision.

The study also found that off-farm businesses in different types contributed to credit diversion as well. This situation is not new and concur with previous findings that in situation when farmers are risk-averse they feel secured if they can diversify sources of income which at some level this can affect the efficient investment for the primary project (Kamakia, 2016; Kuwornu *et al.*, 2012; Oboh & Kushwaha, 2009).

The current results bring attention to the potential benefits and attributions given to the off-farm businesses by the tea farming households in the area which may be explored in further studies to show their economic role to complement the income from the tea production and to revise integrated lending mechanisms for the tea sector.

6.2. Conclusions

This study aimed at contributing to tea sector development in Rwanda through evaluating responsible factors that are influencing the effective utilisation of tea credits and impact on farm income. Specific objectives were formulated and to achieve them, a field survey interview for tea farming households was carried out while different empirical models for data analysis were employed using Stata 16 version.

From the results of this study, the following conclusions can be drawn:

i)   The informal lending sources remain predominant to serve tea farming households for tea credits. Therefore, informal lending sources can fill the gap by providing financial services in rural areas with the limitation of formal banks. Or informal sources can fully meet the liquidity needs of the smallholder tea farmers that are constrained in the formal sector.

ii) Tea cooperatives play a crucial role in reducing the lending gap for farmers with low income. Besides, they have the potential to improve the management and effective utilisation of the credits among tea farmers in the area if formal investors and donors opt to channelise credits through these farmers' cooperatives.

iii) Off-farm businesses are the most competing uses for tea credits in particular when they are received in cash.

iv) Empirical estimates have confirmed the substantial role of tea credits and their positive implication on farm income for both categories of tea farming households; those who utilised credits for tea production and those who diverted tea credits for off-farm uses.

6.3. Recommendations

Based on the results of this study, the following are recommended:

i) There is a need for policy guidance to strengthen informal lending sector farmers-based cooperatives to fill the gap of formal financial services in the rural areas.

If credits are channelised through farmers' cooperatives in kind such as input fertilisers this can reduce incidences related to mismanagement of credits provided in cash among tea farmers.

ii) Credits in form of inputs and procuring farm inputs in bulk should be vigorously pursued to discourage credit diversion.

This was revealed that can increase investment for tea production as individual procuring is almost impossible to ensure the end utilisation of inputs without the role cooperative leaders.

iii) Investigation of off-farm businesses and socio-economic attributes that have real-valued utilities for tea farmers to sustain living needs is needed to alert policymakers on how this affects investment in the tea sector.

This is important when promoting financial inclusion that needs not only financial education but also consideration of the information between credit players on lending mechanisms and between tea chain actors through the Sector Working Group meetings on regular basis to raise one's role for sustainable tea production.

6.4. Areas for further studies

i) Credit utilisation and responsible factors among household farmers for other crop value chains in Rwanda.

ii) Role of financial institutions in the effective utilisation of agricultural credits among smallholder farmers.

iii) Evaluation of the capacity of farmers' organisations/cooperatives and its role in agricultural loans management.

iv) Comparative study for effective utilisation of the credits provided in cash and in-kind among smallholder farmers.

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APPENDICES

Appendix A: Key data analysis output for objective one

```
         name:  <unnamed>
          log:  E:\Final Data\MVPROBIT\MV Probit outputs analyzed.smcl
     log type:  smcl
    opened on:  22 Nov 2019, 02:01:40

. do "C:\Users\Alexis\AppData\Local\Temp\STD00000000.tmp"

. mvprobit (SoCr_Formal= ageHH EducHH HHsize Distance PBPeriod  Cr_info GpCredit collateral TCrMgt TGAP irate LogCr_Size LogHH_Income TeaFSize)(SoCr_Informal= ageHH EducHH HHs
> ize Distance PBPeriod Cr_info GpCredit collateral TCrMgt TGAP irate LogCr_Size LogHH_Income TeaFSize)(SoCr_Combined= ageHH EducHH HHsize Distance PBPeriod Cr_info GpCredit cc
> llateral TCrMgt TGAP irate LogCr_Size LogHH_Income TeaFSize)

Iteration 0:   log likelihood = -351.50501
Warning: cannot do Cholesky factorization of rho matrix
Iteration 1:   log likelihood = -321.68314
Iteration 2:   log likelihood = -304.71947
Iteration 3:   log likelihood = -304.58756
Iteration 4:   log likelihood = -302.93034
Iteration 5:   log likelihood = -302.81121
Iteration 6:   log likelihood = -302.81059
Iteration 7:   log likelihood = -302.81059

Multivariate probit (SML, # draws = 5)        Number of obs   =        358
                                               Wald chi2(42)   =     192.38
Log likelihood = -302.81059                    Prob > chi2     =     0.0000
```

	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
SoCr_Formal						
ageHH	-.0034064	.0075985	-0.45	0.654	-.0182993	.0114864
EducHH	-.0084867	.0220757	-0.38	0.701	-.0517543	.0347809
HHsize	.1050926	.0469451	2.24	0.025	.013082	.1971032
Distance	-.0145211	.0164335	-0.88	0.377	-.0467302	.0176879
PBPeriod	-.0098053	.0083296	-1.18	0.239	-.026131	.0065203
Cr_info	-.1639749	.2042143	-0.80	0.422	-.5642276	.2362778
GpCredit	-.0778983	.1733774	-0.45	0.653	-.4177117	.2619152
collateral	.8549758	.1333006	6.41	0.000	.5937114	1.11624
TCrMgt	-.2205863	.2177897	-1.01	0.311	-.6474463	.2062737
TGAP	.4921403	.297453	1.65	0.098	-.0908569	1.075137
irate	.8505643	.1562156	5.44	0.000	.5443875	1.156741
LogCr_Size	-.1306818	.0886931	-1.47	0.141	-.3045171	.0431536
LogHH_Income	-.1148355	.0818763	-1.40	0.161	-.2753102	.0456391
TeaFSize	.2481928	.1003676	2.47	0.013	.0514759	.4449097
_cons	1.087041	1.527539	0.71	0.477	-1.90688	4.080962
SoCr_Informal						
ageHH	-.0010749	.0097336	-0.11	0.912	-.0201524	.0180026
EducHH	-.0019275	.0247762	-0.08	0.938	-.0504879	.0466328
HHsize	-.0544156	.0553497	-0.98	0.326	-.162899	.0540679
Distance	.0045309	.0200258	0.23	0.821	-.034719	.0437809
PBPeriod	.0102197	.0091194	1.12	0.262	-.007654	.0280933
Cr_info	.2566682	.2376161	1.08	0.280	-.2090508	.7223872
GpCredit	.469309	.2062624	2.28	0.023	.0650421	.873576
collateral	-.0979797	.1406139	-0.70	0.486	-.3735778	.1776185
TCrMgt	-.0273122	.2293835	-0.12	0.905	-.4768955	.4222712
TGAP	.7693343	.3051601	2.52	0.012	.1712316	1.367437
irate	-.1265468	.0968973	-1.31	0.192	-.3164619	.0633684
LogCr_Size	-.8326042	.1201656	-6.93	0.000	-1.068125	-.5970839
LogHH_Income	-.2924512	.1126737	-2.60	0.009	-.5132877	-.0716148
TeaFSize	-.399042	.1124939	-3.55	0.000	-.6195259	-.1785581
_cons	15.21828	2.321502	6.56	0.000	10.66822	19.76834
SoCr_Combined						
ageHH	.0078072	.0091857	0.85	0.395	-.0101964	.0258109
EducHH	.0306796	.0248144	1.24	0.216	-.0179556	.0793149
HHsize	-.0197978	.0516654	-0.38	0.702	-.1210602	.0814646
Distance	.0193509	.0196086	0.99	0.324	-.0190813	.0577831
PBPeriod	.0109793	.0098074	1.12	0.263	-.0082428	.0302015
Cr_info	-.0562442	.229465	-0.25	0.806	-.5059873	.393499
GpCredit	.5042915	.2013449	2.50	0.012	.1096628	.8989203
collateral	-.2492676	.1421149	-1.75	0.079	-.5278077	.0292726
TCrMgt	.0144043	.2239374	0.06	0.949	-.4245049	.4533136
TGAP	.6891423	.2759715	2.50	0.013	.1482481	1.230037
irate	.1160196	.0992892	1.17	0.243	-.0785836	.3106228
LogCr_Size	-.6638111	.1155012	-5.75	0.000	-.8901893	-.4374329
LogHH_Income	-.2139629	.1071487	-2.00	0.046	-.4239705	-.0039554
TeaFSize	-.1176138	.0926232	-1.27	0.204	-.299152	.0639244
_cons	11.38889	2.171013	5.25	0.000	7.133785	15.644
/atrho21	-.2981284	.1210793	-2.46	0.014	-.5354394	-.0608173
/atrho31	-.1027898	.1051832	-0.98	0.328	-.308945	.1033653
/atrho32	1.557039	.2128441	7.32	0.000	1.139872	1.974206
rho21	-.2895989	.1109247	-2.61	0.009	-.489528	-.0607425
rho31	-.1024294	.1040796	-0.98	0.325	-.2994771	.1029988
rho32	.9149394	.0346693	26.39	0.000	.814371	.9621591

```
Likelihood ratio test of  rho21 = rho31 = rho32 = 0:
            chi2(3) =  97.3888   Prob > chi2 = 0.0000

.
end of do-file

. log close
         name:  <unnamed>
          log:  E:\Final Data\MVPROBIT\MV Probit outputs analyzed.smcl
     log type:  smcl
    closed on:  22 Nov 2019, 02:02:15
```

Appendix B: Key data analysis output for objective two

```
     name:  <unnamed>
      log:  E:\Final Data\FRACLOGIT\FRACLogit outputs for analysis.smcl
 log type:  smcl
opened on:  27 Nov 2019, 00:46:37

. fracreg logit CrUtRate gnder ageHH EducHH HHsize GpCredit EXP_Tea CrNoConstr PBPeriod TrainingCrMgt TrainingGAP Cr_Disburs TeaFSize LnTeaPrCost LnHH_Income OffFarmBuss LnCr_S
> ize SoCr_Formal SoCr_Informal, cformat(%9.3f)

Iteration 0:   log pseudolikelihood = -206.28229
Iteration 1:   log pseudolikelihood = -178.63895
Iteration 2:   log pseudolikelihood = -177.96549
Iteration 3:   log pseudolikelihood = -177.96415
Iteration 4:   log pseudolikelihood = -177.96415

Fractional logistic regression              Number of obs   =        358
                                            Wald chi2(18)   =     226.88
                                            Prob > chi2     =     0.0000
Log pseudolikelihood = -177.96415           Pseudo R2       =     0.1929
```

CrUtRate	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
gnder	0.208	0.201	1.04	0.300	-0.186	0.602
ageHH	0.005	0.007	0.79	0.427	-0.008	0.019
EducHH	-0.001	0.016	-0.05	0.957	-0.033	0.031
HHsize	-0.002	0.042	-0.05	0.961	-0.084	0.080
GpCredit	0.439	0.134	3.27	0.001	0.176	0.702
EXP_Tea	-0.012	0.032	-0.38	0.702	-0.075	0.051
CrNoConstr	0.559	0.238	2.35	0.019	0.093	1.025
PBPeriod	-0.012	0.008	-1.38	0.166	-0.028	0.005
TrainingCrMgt	0.672	0.178	3.77	0.000	0.323	1.021
TrainingGAP	0.434	0.091	4.74	0.000	0.254	0.613
Cr_Disburs	-0.007	0.006	-1.19	0.236	-0.018	0.004
TeaFSize	0.105	0.121	0.87	0.384	-0.132	0.342
LnTeaPrCost	0.972	0.198	4.91	0.000	0.584	1.361
LnHH_Income	0.057	0.070	0.82	0.415	-0.080	0.194
OffFarmBuss	-0.508	0.081	-6.29	0.000	-0.666	-0.350
LnCr_Size	-0.613	0.153	-4.00	0.000	-0.913	-0.312
SoCr_Formal	0.302	0.162	1.86	0.062	-0.016	0.620
SoCr_Informal	0.763	0.224	3.40	0.001	0.323	1.203
_cons	-0.825	0.489	-1.69	0.091	-1.784	0.133

```
. log off
     name:  <unnamed>
      log:  E:\Final Data\FRACLOGIT\FRACLogit outputs for analysis.smcl
 log type:  smcl
paused on:  27 Nov 2019, 00:46:52
```

Appendix C: Key data analysis output for objective three

```
. do "C:\Users\Alexis\AppData\Local\Temp\STD25c4_000000.tmp"

. movestay logtea_income gnder age_hh Education tea_fsize exp_teafm cr_nonconst t_GAP t_CrMgt fin_visit tea_labcos
> t1 tea_inputcost1, select(teaCr_alloc = gnder age_hh Education tea_fsize exp_teafm cr_nonconst t_GAP t_CrMgt fin
> _visit tea_labcost1 tea_inputcost1 poffbuss logcr_size  gp_credit )


Fitting initial values .....
Iteration 0:   log likelihood = -686.09131
Iteration 1:   log likelihood = -684.21947
Iteration 2:   log likelihood = -684.20682
Iteration 3:   log likelihood = -684.20682

Endogenous switching regression model        Number of obs    =       358
                                             Wald chi2(11)    =     98.22
Log likelihood = -684.20682                  Prob > chi2      =    0.0000
```

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
logtea_income_1						
gnder	.1133851	.2214365	0.51	0.609	-.3206225	.5473928
age_hh	.0094681	.0072472	1.31	0.191	-.0047362	.0236724
Education	.0128221	.0202677	0.63	0.527	-.0269019	.0525461
tea_fsize	.3276463	.1086078	3.02	0.003	.1147789	.5405136
exp_teafm	.0712861	.039723	1.79	0.073	-.0065694	.1491417
cr_nonconst	.1449992	.196168	0.74	0.460	-.2394829	.5294814
t_GAP	.8220117	.349999	2.35	0.019	.1360263	1.507997
t_CrMgt	.4658387	.1980859	2.35	0.019	.0775976	.8540799
fin_visit	.0636478	.1695843	0.38	0.707	-.2687313	.3960269
tea_labcost1	.1695746	.05072	3.34	0.001	.0701653	.268984
tea_inputcost1	.1802853	.0588851	3.06	0.002	.0648725	.295698
_cons	9.484523	.6246103	15.18	0.000	8.260309	10.70874
logtea_income_0						
gnder	-.024499	.203738	-0.12	0.904	-.4238182	.3748202
age_hh	.0133647	.0076929	1.74	0.082	-.0017132	.0284426
Education	-.0275781	.0195901	-1.41	0.159	-.065974	.0108177
tea_fsize	.4543887	.1064921	4.27	0.000	.2456681	.6631093
exp_teafm	.0839229	.0380662	2.20	0.027	.0093146	.1585313
cr_nonconst	-.2654934	.2627858	-1.01	0.312	-.780544	.2495572
t_GAP	.4833795	.2202161	2.20	0.028	.0517638	.9149952
t_CrMgt	.3269001	.22082	1.48	0.139	-.1058992	.7596994
fin_visit	.3837574	.1776429	2.16	0.031	.0355836	.7319311
tea_labcost1	.1270441	.0677866	1.87	0.061	-.0058151	.2599033
tea_inputcost1	.2446021	.0901885	2.71	0.007	.067836	.4213682
_cons	10.22399	.573774	17.82	0.000	9.099412	11.34856
teaCr_alloc						
gnder	-.0454487	.207728	-0.22	0.827	-.4525881	.3616906
age_hh	.009017	.0072975	1.24	0.217	-.0052858	.0233198
Education	.0180012	.0200079	0.90	0.368	-.0212136	.057216
tea_fsize	.112217	.1032561	1.09	0.277	-.0901611	.3145591
exp_teafm	-.0399805	.0397412	-1.01	0.314	-.1178719	.0379109
cr_nonconst	-.2074413	.2204119	-0.94	0.347	-.6394407	.224558
t_GAP	1.012413	.2458228	4.12	0.000	.5306094	1.494217
t_CrMgt	.7588982	.2207209	3.44	0.001	.3262932	1.191503
tea_labcost1	.3198051	.0680736	4.70	0.000	.1863833	.4532269
tea_inputcost1	.3174664	.0906325	3.50	0.000	.13983	.4951028
fin_visit	-.1451068	.1746752	-0.83	0.406	-.487464	.1972503
poffbuss	-.8924116	.1666912	-5.35	0.000	-1.21912	-.5657028
logcr_size	-.7110031	.0956973	-7.43	0.000	-.8986543	-.5235278
gp_credit	.4998591	.1567639	3.19	0.001	.1926075	.8071107
_cons	7.374292	1.110691	6.64	0.000	5.197378	9.551206
/lns1	.1574024	.0568215	2.77	0.006	.0460342	.2687706
/lns2	-.0118314	.0657787	-0.18	0.857	-.1407554	.1170925
/r1	.4667846	.1944543	2.40	0.016	.0856612	.847908
/r2	.545352	.1756711	3.10	0.002	.2010429	.8896611
sigma_1	1.170467	.0665077			1.04711	1.308355
sigma_2	.9882383	.0650051			.8687018	1.124223
rho_1	.4355977	.1575575			.0854523	.689975
rho_2	.4970285	.1322738			.1983774	.7112263

```
LR test of indep. eqns. :            chi2(1) =    14.35   Prob > chi2 = 0.0002


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Appendix D: Published paper on objective one

Factors Influencing Tea Farmers' Decisions to Utilize Sources of Credit in Nyaruguru District, Rwanda: A Multivariate Probit Regression Analysis

A. Kabayiza[1*], G. Owuor[2], J. K. Langat[2], and F. Niyitanga[1]

ABSTRACT

Credit is a major tool and an important factor for tea production and farm outcome. Its demand from different lending sources has been increasing to meet capital investment in the tea sector. Accessed credit is to meet costs of tea production, mainly fertilizers, seedlings, and labor as well. Factors affecting access to credit have been a subject of vast debate in recent studies that credit seekers obtain credits only when they are eligible by complying with the requirements set by lending institutions. However, literature has limited findings on the behavior of small-scale borrowers in selecting a credit source and inducing factors. In particular, borrowing arrangements necessitate the analysis to inform policy makers on needed adjustment in the lending system to improve tea production and sector development. The study aims at disclosing responsible factors to choose a particular credit source by smallholder tea farmers. A survey was conducted with 358 tea growers selected randomly in two cooperatives that operated in Nyaruguru District. A multivariate probit model was used for analytical analysis. Borrowing from formal source (commercial banks) increased if borrower possessed collateral asset (85.5%), interest rate (85.0%) size of tea plantation (24.8%) and household composition (10.5%). Using informal sources increased if a farmer desired a small credit (83.2%), participated in technical training (76.9%), and received joint credit (46.9%), while a farmer was likely to use less informal sources if his/her farm size (39.9%) and household income (29.2%) were small. However, combining sources of credit was used by farmers as a safeguard strategy to acquire the desired loan. A government policy, which aims to increase productive investment, should emphasize integrating agricultural loans in financial system targeting smallholder farmers through their organizations where they can relax credit constraints.

Keywords: Credit constraints, Formal loan sources, Government policy, Informal loan source.

INTRODUCTION

Tea and coffee are dominant cash crops since the colonial period (the 1930s) in Rwanda. Over the period, the two crops are still leading foreign earnings from agricultural exports (World Bank, 2019). The small-scale tea farmers own 70% of the total tea plantations and production of the processing tea factories depends on a daily supply of green tea leaves from these farmers (World Bank, 2013). Since 2013, the tea expansion program that integrates modern agricultural practices in Rwanda has required farmers to increase the capital to purchase farm inputs in order to meet the national export targets for the sector (MINICOM, 2013). Tea household farmers will need to increase the rate of fertilizer inputs, rehabilitation of the old tea plantations, increasing tea fields acreage, and to meet the cost for plucking and transportation of the produce to the processing factories. As a result, credit is a major tool and an important factor for tea production and farm outcome.

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Appendix E: Published paper on objective two

Drivers to Utilize Farm Credits: Lessons From Tea Farmers of the Nyaruguru District in Southern Province, Rwanda

Authors: Alexis Kabayiza, George Owuor, Jackson K. Langat, & Fidèle Niyitanga

Drivers to Utilize Farm Credits:
Lessons From Tea Farmers of the Nyaruguru District in Southern Province, Rwanda

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Abstract

This paper examines the factors of credit utilization for tea enterprise production and the conditions to inform stakeholders and policymakers in the Rwandan tea sector. Through purposive and random techniques, the study used data collected from 358 tea-farming households. A fractional regression model was utilized in the analysis. Factors like access to credit in group ($p<0.01$), training on tea agricultural practices and credit management ($p<0.01$), level of production costs ($p<0.01$) and type of lending sources ($p<0.01$) were shown to influence the rate of credit allocated for tea production projects while engagement of tea-farming households in off-farm businesses ($p<0.01$) and larger size of credit($p<0.01$) both increased incidences of credit diversion to other than tea farming uses. Policymakers can intervene for mechanisms that improve management and accountability of tea farmers' organizations as emerging players in the tea sector. Also, public policies should integrate other economic and social attributes that may have real-valued utilities for rural tea-farming households to sustain living needs if they have the right to choose, and engage in, certain range of income activities.

Keywords: tea credit, credit diversion, credit utilization, fractional regression model, tea-farming household interest

Appendix E: Published paper on objective three

DOES CREDIT UTILIZATION LEAD TO INCREASING FARM OUTCOME? A MICRO-PERSPECTIVE OF TEA PRODUCTION FROM RWANDA

*[1]Kabayiza A., [2]Owuor G., [2]Langat K.J., [1]Mugenzi P. and [1]Niyitanga F.

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Egerton University, Kenya

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ABSTRACT
Credit is a crucial factor for tea growers to pay for physical farm inputs mainly input fertilizers, research and development of high yielding tea clones and labour in order to improve the production of green tea leaf and to meet factories' demand for raw materials. However, mismanagement of accessed credits by farmers has been reported among the snags affecting the sector development. The study analyzed the determinants and impact of credit utilization on farm income among smallholder tea growers in Nyaruguru District, Rwanda. Cross-sectional tea household level data were collected from 358 farmers randomly selected from tea cooperatives. The credit utilization and causal effect were estimated using the Endogenous Switching Regression model. Results showed a positive and significant relationship between credit utilization and tea farm income. Precisely, the causal effect of credit is a 7% increase in tea income for farmers who utilised credit for tea production, while its potential effect is up to a 55% decrease in tea income for those who divert credit for out-off tea production uses. Furthermore, training on good agricultural practices and credit management, cost of farm inputs, labour and access to group credit significantly influence utilization of credit for tea production. However, the size of credit (cash) and off-farm businesses significantly increase the diversion of credit and level of tea farm income. Tea farmers are encouraged to use tea credits for planned projects. Sensitizing farmers to procure farm input fertilizers in bulk through cooperatives should be vigorously pursued to discourage credit diversion.

Key words: tea credits, tea farming households, farm income, endogenous switching regression

INTRODUCTION
Agriculture investment is a national priority for transforming agriculture and greater financial inclusion. The yielded substantial progress in financing agriculture results from government's funding measures for access to financial services for farmers and agribusinesses through the Financial Sector Development Program (2013-2018), The National Financial Inclusion Strategy (NFIS) and the National Agriculture Policy (NAP) (GoR, 2012). Rwanda additionally so has two key market development entities-the Development Bank of Rwanda (BRD) and the Business Development Fund (BDF) both are active in the financing agriculture sector. Through the National Bank of Rwanda (NBR) there is a system of monitoring credit disbursed to the agriculture by value chains and value chain stages in all financial institutions-commercial banks, Microfinance (MFIs) and SACCOs. According to the World Bank (2018), agri-finance is a key focus area for Access to Finance, and Rwanda plays a role of a specialized donor-funded initiative and for the World Bank's lending projects. As result, the loans for agriculture increased from 57 billion in 2012 to a 90 billion in 2016 (World Bank, 2018) with agri-processing and tea production as the leading investment over this period.

Tea production was among the country priorities for reforms implemented in the agriculture transformation since 2013 because of its economic role for the country (World Bank, 2013). Tea production plays an important role in the establishment of tea factories, job creation for rural communities by increasing farmers' daily income and finally, its exports' share remains significant in the foreign exchange balance for countries like Rwanda (FAO, 2020). Furthermore, the tea sector in Rwanda offers additional advantages. In particular, tea cultivation helps to enhance the productivity of acidic soils, fighting erosion and runoff in South-Western regions. Economically, the government of Rwanda views the tea sector in the loop of increasing tea export volumes reaching 3% of the global market by 2024 (NAEB, 2019).

Appendix F: Paper presented on objective one at egerton university 13th international conference on innovation, research and transformation for sustainable development

Appendix G: Paper on objective three submitted at icae 2021 international conference on agricultural economists -august 17-31, 2021 -online

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Determinants and Effect Evaluation of Credits on the Farm Outcome – a Micro-Perspective of Tea Production from Rwanda

Alexis Kabayiza[1], George Owuor[2], Jackson K. Langat[2], Patrice Mugenzi[1] and Fidèle Niyitanga[1], (1)University of Rwanda, Rwanda, (2)Egerton University, Kenya

Credit is important factor for tea growers to pay for inputs mainly fertilizers to improve green tea leaf production and to meet factories' demand for raw materials. Along with made interventions to increase funds, mismanagement of credits by farmers has been reported among the issues for the sector development that remains suboptimal. The study analyzed the determinants and impact of tea credits utilized among tea-farming households in Rwanda. Cross-sectional tea household level data were collected from 358 farmers randomly selected from tea cooperatives. The credit utilization and causal effect were estimated using endogenous switching regression model. Results revealed positive effect as 7% increase in tea income when credits are utilized for tea production while their potential effect is up to 55% decrease in tea income when they are diverted for out-off farm uses. Training on agricultural practices, credit management, cost of farm inputs, labour and access to group credit influence utilizing of credit for tea production. However, size of credit and off-farm businesses increase diversion of credit and level of tea farm income. Farmers are encouraged to use credits for planned projects. Sensitizing farmers to procure input fertilizers in bulk through cooperatives should be vigorously pursued to discourage credit diversion.

Full paper:
- [pdf] Manuscript for presentation in ICAE.pdf (228.1KB) - Full paper

Agreements:
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Title:
Determinants and Effect Evaluation of Credits on the Farm Outcome - a Micro-Perspective of Tea Production from Rwanda

Submitter's E-mail Address:
akabayiza@gmail.com

JEL Codes:
Q010 Sustainable Development
Q130 Agricultural Markets and Marketing; Cooperatives; Agribusiness
Q120 Micro Analysis of Farm Firms, Farm Households, and Farm Input Markets

Prize(s) applied for:
Nils Westermarck Prize

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Email: lfniyitanga@gmail.com -- Will not be published

To access your submission, use the direct link to your contributed paper submission from one of the automatic confirmation e-mails that were sent throughout the submission process.
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When you have completed your submission, you may close this browser window.

Home Page

Appendix H: Research permit

NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY (NCST)
Grand Pension Plaza, 13th Floor, KN 2 Roundabout, Kigali
PO Box: 2285 Kigali – Rwanda
E-MAIL: info@ncst.gov.rw ,WEBSITE: www.ncst.gov.rw

PERMISSION TO CONDUCT RESEARCH IN RWANDA

N° NCST/482/115/2018

I, the undersigned, hereby grant the researcher (s) in Section I permission to conduct research in Rwanda. This permission only covers research activities related to the provided research title, during the specified period and at specified location (s) in Section II of this form.

Section I: Personal Information

1. Family Name: **KABAYIZA**   Other Names: **ALEXIS**

2. Academic Qualification (Highest degree): **MS, MA**

3. Home Institution: **EGERTON UNIVERSITY**   Occupation: **PhD Student**

4. Phone Number (in Rwanda): **+250 788403472**

5. Email: **akabayiza@gmail.com**

6. Primary Research Supervisor:

    a. Names: **Dr. Niyitanga Fidele**

    b. Institution: **University of Rwanda**   Occupation: **Senior Le...**

    c. Phone Number: **+250 788624094**

    d. Email: **fniyitanga@yahoo.fr**

7. Research Collaborators:

	Names	Institution
1		
2		
3		
4		

P a g e | 1

163

Section II: Research Information

1. Research Area: **Agriculture**

2. Research Title: **Factors affecting tea credit utilization and effect on farm income in Southern Province of Rwanda**

3. Affiliating Rwandan Institution: **University of Rwanda, CAVM**

4. Rwandan Supervisor:

   a. Names: **Dr Niyitanga Fidele**

   b. Occupation: **Senior Lecturer**

   c. Phone Number: **+250 788624094**   d. Email: **fniyitanga@yahoo.fr**

5. Fieldwork Location:

   Nyaruguru District

6. Research Period:

   a. From: **May 09, 2019**

   b. To: **September 09, 2019**
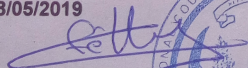
Section III: Other Important Notes

Section IV: Signature

This permission to conduct research in Rwanda is issued in accordance with Ministerial Instructions 003/2010 of 09/12/2010 regulating research activities in Rwanda.

Kigali, on **08/05/2019**   NCST Ref: ..   ../NCST.2018

KALISA M. Felly

Ag. Executive Secretary

Appendix J: Questionnaire used for survey

Greetings,

Dear sir/madam,

I am Alexis Kabayiza, a PhD Agribusiness Management student in Egerton University, Kenya. Currently I am conducting a survey on the aforementioned titled research. The following are self-explanatory questions that will not take much of your time to answer when you are assisted with a surveyor. Your ethical responses will contribute much towards achieving the specific objectives of the study. Your responses will be treated strictly confidential, and purely for academic purpose.

In case it is not clear or for any enquiry about this research, please do not hesitate to contact the researcher.

Thank you,

Alexis KABAYIZA
Phone: +250788403472
Email: akabayiza@gmail.com

A. Identification of the respondent

A.1. Code of questionnaire: ....

A.2. Names of interviewee: ....

A.3. Nearest tea factory name: ....

A.4. Sector: ....

A.5. Cell: ....

A.6. Village: ....

A.7. Date of survey: Day: ....Month: ....Year: ....

A.8. Name of enumerator: ....Telephone number: ....

B. FARME'S CHARACTERISTICS

Category/Level	B1. Gender 1.Male 2.Female	B2. Age (in years)	B3. Marital 1.Married 2.Divorced 3.Single	B4. Highest education (levels)	B5. HH size (no of HH dependents)	B6. Experience in Tea production (no. of years)
Head of HH Respondent						
Codes for B4	1. Informal education 4. university 2. primary school 5. Vocational training 3. secondary school					

B7. Household composition including household head or respondent

1. Number of Male: _____ of Female: _____

2. How many are under 18 years _____

3. How many are 65 years old or more _____

B8. Highest education level for household members (in number)

1. primary education_____

2. secondary school_____

3. vocational training _____

4. college/University_____

B9. How many are employed_____

C. HOUSEHOLD ASSETS

C1**. Homestead ownership**

C1A. Are you the owner of the house (s) in the homestead? Yes ☐   No: ☐

C1B. If no, what is your renting costs? …………………………..........................Frw/year

C2. **Household owned Assets**		
Items	**Quantity**	**Total forced/ selling Value of (Frw)**
C2A. Houses		
C2B. Land Parcels		
C2C. Motorised Vehicles		
C2D. Financial Assets (shares in SACCO….)		
C2E. Home Electricity (Generator, Solar Panel etc.)		
C2F. Motorbike		
C2G. Bicycle		
C2H. Television set & Accessories		
C2I. Radio		
C2J. Equipped sitting saloon (modern chairs &tables etc)		

C2K. Properties:
   1. Rental house
   2. Commercial house
   3. Residential house		

Total Assets Value		
C3. Livestock Assets		
C3A. Cattle		
C3B. Goats		
C3C. Sheep		
C3D. Pigs		
C3E. Small Animals (Rabbits, chickens, etc.)		
C3F. Cowshed		
C3G. Other no specified assets		
Total Livestock Value		

OBJECTIVE ONE: SOURCE OF CREDIT AND CHOICE OF USING A PARTICULAR SOURCE OF CREDIT

D. Available source of credit in study area

D1. At your knowledge, list available financial institutions that are operating in Nyaruguru District

1.	**6.**	**10.**
2.	**7.**	**11.**
3.	**8.**	**12.**
4.	**9.**	**13.**

D2. To your knowledge,

D2A. Do you know any SACCO operating in Nyaruguru district?   Yes:……. No:……

If yes, how many do know…………………………...Distance to nearest one………………… Km

D2B. Are there Microfinances operating in Nyaruguru district?   Yes:……. No:……

If yes, how many do know…………………………...Distance to nearest one………………… Km

D2C. Are commercial banks operating in Nyaruguru district?   Yes:……. No:……

If yes, how many do know…………………………...Distance to nearest one………………… Km

D2D. Are you a member of any ROSCA?   Yes:……. No:……

If yes, how many are you a member of……………………………...

For each ROSCA, specify its name:………………………….and distance to reach a place of meeting………Km

name:………………………….and distance to reach a place of meeting………Km

D2E. Can a tea farmer borrow from: A friend (s)?   Yes:……. No:……..

A relative (s)?   Yes:……. No:……..

An input supplier(s)?   Yes:……. No:…….., if yes, distance……… Km

A tea cooperative?   Yes:……. No:…….., if yes, distance……… Km

A tea factory?   Yes:……. No:…….., if yes, distance……… Km

If any other identified source, please specify name…………………………and distance……………………………Km

E1. Factors to choose a source of credit

1. Where did you get a credit in the last 3 years? Please tick in list below:

a. Commercial banks (specify)   b. Microfinance   c. SACCO   d. ROSCA   e. Tea cooperative   f. Tea factory

g. Input supplier   h. Relative   i. Friend(s)   j. Other (specify)

E2. Why did you choose to get credit from this/these particular source(s) of credit?

Refer to previous answers in table above	Yes	No
1. Did you have information about conditions and requirements before applying for a credit?		
2. Were you interested by credit lenders to come and apply for credit?		
3. Were you interested by cooperative leaders to use this particular source of credit?		
4. Were you mobilized by government agents/institution to apply for this credit source?		
5. Are you already known by lender(s) even before applying for credit?		
6. Was it because of time constraint (it takes a short time to get feedback about desired credit)		
7. Was it a single/individual credit?		
8. Was it a group credit?		
9. Did you believe that you can get a credit size you desired before applying for a credit?		
10. Have you had a required collateral asked for to get a credit?		
11. Was it the only source of credit for tea businesses		
12. Was it first time you get credit from this source?		
13. Did you get training before on credit management?		
14. Did you get training on good agricultural practices from extension agents/agronomists?		
15. Do you have any other reason of using this particular source of credit? plz specify..................................		

E3. Source of credit (in cash)

Source of credit	In cash, Value in Frw	G2D. Interest rate (%) if applicable	Experience in using credit 1= 1st Credit 2= 2nd Credit	Credit constraints	Repayment period (no. of months)	Period to get credit in days	Collateral/guarantee required 1. Yes	Mean of transport home to lending source 1.Car,	Distance in km

			3= More than 2	1= if you had received total amount 2= if you had received less than requested amount			2. No	2. Motorbike, 3. Bicycle, 4. Walking	
Comm. Banks									
Microfinance									
SACCOs									
ROSCA[13]									
Tea cooperative									
Tea factory									
Input supplier									
Relatives									
Friends									
Other, specify									

E4. Source of credit (in kind)

Source of credit	Type of credit[14]: 1.Fertilizer 2.Pesticides	In Kind, Value in Frw	Interest rate (%) if	Related Cost include cost	Experience in using credit 1= 1st Credit	Credit constraints	Repayment period	Period to get	Collateral/guarant	Dist. in km

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[13] Rotating savings and credit groups

[14] Types of credits in kind can be combined, example fertilizer and equipment can be indicated by 1&3 and their sum value in the following column

	3.Equipment 4.others		applicable	of valuing asset (Frw)	2= 2nd Credit 3= More than 2	1= if you had received desired input quantities 2= if you had received less than desired qty	(no. of months)	credit in days	ee required 1. Yes 2. No	
Comm. Banks										
Microfinance										
SACCOs										
ROSCA										
Tea cooperative										
Tea factory										
Input supplier										
Relatives										
Friends										
Other, specify										

OBJECTIVE 2: CREDIT UTILISATION

F1. Credit usage

F1A.Types and intended use of credit when applying for a loan:	F1B.What was the purpose of applying for a loan: Just tick	F1C. How much did you spend for (Frw)
Tea farming use:		
1. Purchase fertilizers	☐	☐
2. Purchase pesticides	☐	☐
3. Hiring labour	☐	☐
4. Purchase of tea seeds	☐	☐

☐

☐

☐

☐

5. Development of new tea plantation		☐
6. Rehabilitation of old tea plantations		☐
7. Transporting green tea leaves		☐
8. Tea farm equipment (transportation vans, pumps, sheeting, baskets etc.)		☐
9. Others specify:..........................		
Non-tea farm use:		
1. Inputs for other crops	☐	☐
2. Seeds for other crops	☐	☐
3. Trading activities	☐	☐
4. Public transportation	☐	☐
5. Acquiring and feed livestock	☐	☐
6. Others specify:....................	☐	☐
		☐
Household needs:		
1. School fees	☐	☐
2. Health insurance fees	☐	☐
3. Buy food & clothes	☐	☐
4. Building a house	☐	☐
5. Social events (marriage, death, social supports)	☐	☐
6. Others specify:		

F2. Credit constraint in last 3 years

1. Had you received all amount when you applied for a credit? Yes ☐ No ☐

2. If yes, how much?

3. If no, answer the following question and repeat for both in **cash** & in **kind**

F2A.Credit usage (A)	Total of requested credit in cash (Frw)	Total of credit received in cash (Frw)	Total credit used for tea production in cash (Frw)	Credit used out of tea farm activities in cash (Frw)
F2B.Credit usage(B)	Total of value of requested credit in kind (Frw)	Total of value of credit received in kind (Frw)	Total of value of credit used for tea production in kind (Frw)	Value of credit used out of tea farm activities in kind (Frw)
Total credit (Frw) (A+B)				

F3. Received trainings and extension services

Received trainings	Indicate 1=Yes 2=No	If yes which techniques/topics Covered during trainings?	Responsible trainer institution/ person	Number of training received in last 3 years	Number of visits of extension agent per season (6 months)
Tea related farming techniques		1. 2. 3. 4. 5. 6.	1. 2. 3. 4. 5. 6.	1. 2. 3. 4. 5. 6.	1. 2. 3. 4. 5. 6.
Training on financial services/field visits		If yes which related technique/topic you were trained on?	Responsible trainer institution/ person	Number of training received in last 3 years	Number of visits of extension agent per season (6 months)

Credit related use & management		1. 2. 3. 4. 5. 6.	1. 2. 3. 4. 5. 6..	1. 2. 3. 4. 5. 6.	1. 2. 3. 4. 5. 6.
Any other received training:					

OBJECTIVE 3 INCOME FROM TEA FARM

G. Land tenure by household

G1A Total land size (Ha)	G1B. Size of owned land allocated for tea production (Ha)		G1C. Size of hired land for tea production (Ha)		G1D.Size of land allocated to other food crops (Ha)		G1E.Size of land allocated to other cash crops (Ha)		G1F. Size of land reserved for grazing (Ha)	
	Size of land (Ha)	Market Value (Frw)	Size of land (Ha)	Market Value (Frw)	Size of land (Ha)	Market Value (Frw)	Size of land (Ha)	Market Value (Frw)	Size of land (Ha)	Market Value (Ha)

H. Cost of tea production

H1A. Types of inputs for tea production	H1B. Name or type of[15]:	H1E. Quantity of Inputs (specify unit)	H1D. Unit cost per input (Frw/Unit)	Total cost of inputs/Equipment (Frw)
1. Fertilizers				
2. Pesticides				
3. Seeds / seedlings				
4. Organic manure				
5. Other inputs				
6. Farm equipment				
E2A. Tea farm labour	E2B. Source of labour *1: Household labour* *2: Hired labour* *3: Both*	E2C. Estimated labour days per year	E2D. Unit cost per labour/day (Frw)	E2E. Tot. annual labour cost (Frw)
Land preparation				
Planting				
Maintenance/rehabilitation/renew Plantation				
Plucking				
Transporting to nearest collection centre/ factory				

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[15] For example, type of fertilizers, one may indicate as NPK, Urea etc.

I. HOUSEHOLD INCOME

I1. Tea farm income

I1A. Quantity of supplied green tea leaves to factory in the last 3 years	I1B. Unit price (Frw /kg)	I1C. Total income from tea farm (Frw)
S/Total income from tea production (Frw)		

I2. NON-TEA FARM INCOME

A. Income from other produced crops

I2A. List of crops that are generating income when sold	I2B. Types of crops 1.Food crops 2.Cash crops (tea excluded)	I2C. Estimated sold quantity of crop (kg) last 12 months	I2D. Market price / kg/ crop (Frw)	I2E. Total gross revenue from sold crops (Frw)
1.				
2.				
3.				
4.				
5.				
6.				
7.				
S/Total income from other produced crops (Frw)				

B. Income from Livestock

I3A. Types and list of sold animals	I3B. quantity of animals sold (last 12 months)	I3C. market price/ head animal (Frw)	I3D. Revenue realised from livestock in last 12 months (Frw)
1.			
2.			
3.			
4.			
5.			
S/Total income from livestock (Frw)			

I3. Household off-tea employment

Primary job occupation in last 12 years					Secondary job occupation in last 12 years			
No of employed persons within HH[16]	I3A. Sector of activity	I3B. Employment status	I3C. Experience in this Job (years)	I3D. Net Income from this Job? (FRW/12 months)[17]	I3E. Sector of activity	I3F. Employment status	I3G. Experience in this Job (years)	I3H. Net Income from this Job? (FRW/12 months)
1.								
2.								
3.								
4.								
S/Total income from off-farm employability (FRW)								

Field codes for I3A and I3E: 1. Agriculture (1)   2. Non-Agriculture (including processing Agricultural products)

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[16] Equivalent with answer for B9

[17] For I3D & I3H, annual net income will require to demand monthly income and then multiply with 12 months

Field codes for I3B and I3F: 1. Self-Employed   2. Employed

I4. OTHER SOURCE OF INCOME (Gifts & other Benefits) *(Record only for the last 12 months)*

I4A. Rented out land and/ or other properties (Frw)	I4B. Income from forests (Frw)	I4C. Receives (from government or NGOs Programs) (Frw)	I4D. Pension income (Frw)	I4E. Remittances (sent from friends, relatives living elsewhere) (Frw)	I4F. Others (Specify…..........)	I4G. Total income from other sources (Frw)

Thank you for your cooperation